NINETY-SEVENTH YEAR

AMERICAN Gas Journal

FEBRUARY 1956

Only Magazine Published Exclusively for the Gas Utility Industry

APR 1 °
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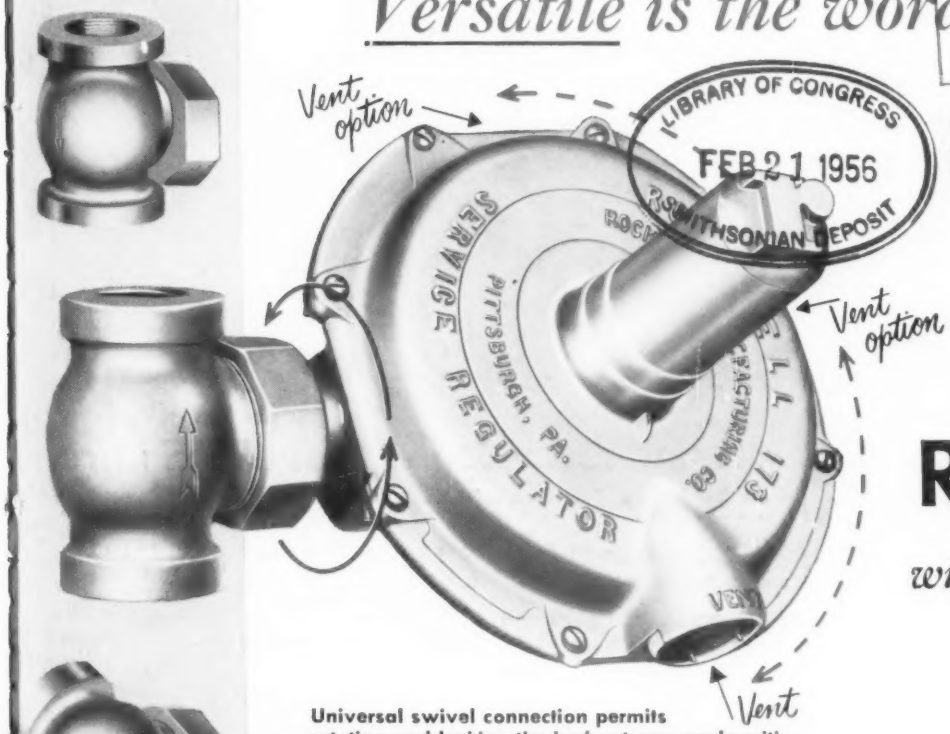
SMITHSONIAN DEPOSIT

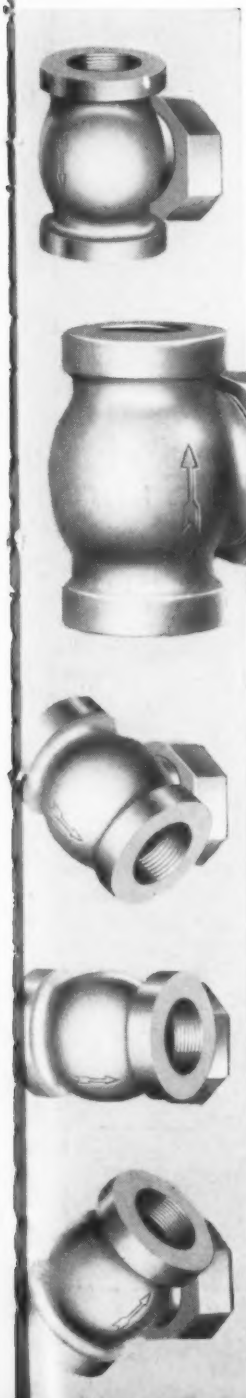
Versatile is the word for...

Rockwell "173" Service Regulators

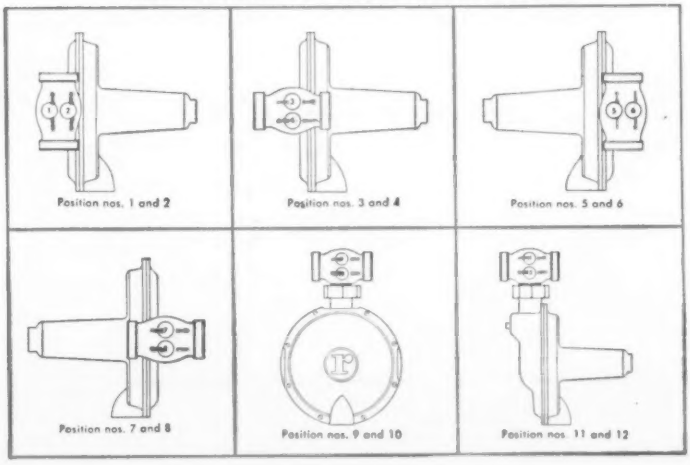
with Down Drain Cover



Universal swivel connection permits rotating and locking the body at any angle with the pipe. The cover can be detached and turned so that the vent always drains downward.



ADAPTABLE TO ANY MOUNTING



Here's new ease and convenience in service regulator installation, particularly on difficult jobs such as pressure elevation.

There are 12 standard factory assembly positions available (see diagrams). Thereafter, the diaphragm case can be rotated to any position by simply loosening the swivel nut. Such versatility in application eliminates the problem of stocking right and left-hand assemblies or top and bottom inlet models. For full description of this and other Rockwell service regulators write for bulletin 1026.

ROCKWELL MANUFACTURING CO.

Pittsburgh 8, Pa.

Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa *In Canada:* Rockwell Manufacturing Co. of Canada, Ltd., Toronto, Ontario

Utilities pipeline contractor

Averages 20 feet of trench per minute, digs 2 to 4 jobs per day with each of his Clevelands

1000 feet of complete pipeline construction—trench digging, pipelaying, backfilling and backfill compaction—is an average day's work for each crew of F. H. Linneman, Inc., pipeline and utilities contractor of Denver. Most of this work is on 2-, 4- and 6-inch pipelines for the many new housing developments in the Denver area.

With a Cleveland Trencher opening up trench at an average rate of 20 feet per minute, a typical Linneman crew will do 2, 3 or 4 complete pipeline jobs in an 8-hour day—jobs that run from 50 to 1000 feet each in length. One of these crews has a record day's production of 7 complete jobs.

Currently operating 7 Cleveland Trenchers, Linneman specializes in utilities work—gas, water and sewer line construction. Equipment-minded and especially maintenance-conscious, he has consistently employed Clevelands ever since he began his contracting business in 1946.

Fast portability of equipment is essential in Linneman's tight-scheduled operations. His Clevelands can be loaded on their low-bed trailers in less than 10 minutes time, ready to roll safely from job to job at legal limit speeds.

"Maintenance costs on Clevelands are appreciably lower" says owner of 7

Here is what F. H. Linneman has to say about trenchers:

"In the type of work we most generally perform, in the city especially, we have found Clevelands best suited to our operations because of their narrow-width construction, compactness and speed. They enable us to work in close places and keep trenching ahead of follow-up operations, a decided advantage.

"We have employed Clevelands in our work since we began contracting in 1946. We have seven of them at the present time, the oldest being a Cleveland Model 95 purchased in 1948. We have no record of the miles this machine has dug, but feel that it would be a near-record. Our maintenance costs on it have been extremely low.

"Our over-all maintenance costs on Clevelands are appreciably lower than on other trenchers we have operated. This is another reason why we have purchased more Clevelands than any other make. We have also found it easier to train operators for Clevelands than for any other make. Our newest Cleveland, a "240," was delivered only last week by H. W. Moore Equipment Co., here in Denver."

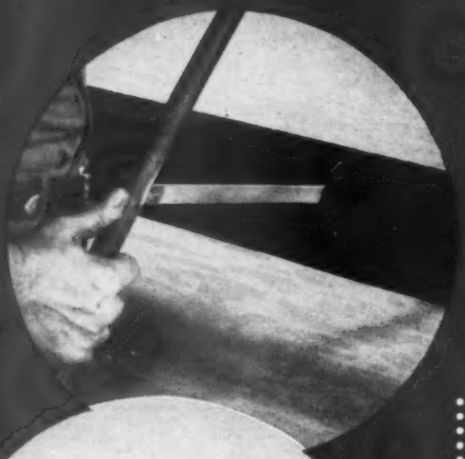
THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave. Cleveland 17, Ohio

CLEVELAND

For quick SHUT-OFFS

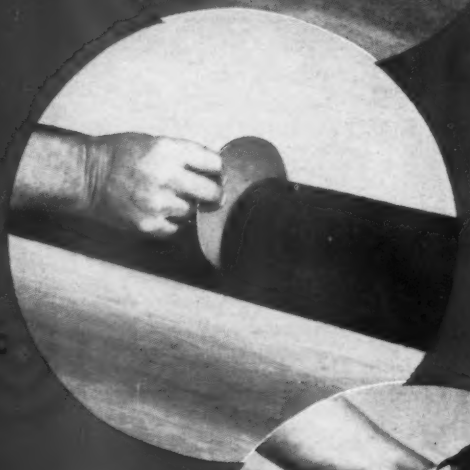
SLOT

1. SAW SLOT



DISC

2. INSERT DISC



CLAMP

3. APPLY CLAMP

4. When ready to resume pressure, loosen clamp, remove disc, install brass band, re-center clamp, tighten — and you're through!

Enormous Savings Compared to Cutting-in Expensive Valves!

Write For Special Bulletin!

M. B. SKINNER CO., SOUTH BEND 21, IND.

SKINNER-SEAL SPLIT COUPLING CLAMP

2" TO 24" INCL.

Twenty-eight thousand metermen drowned in flooded basements last year!

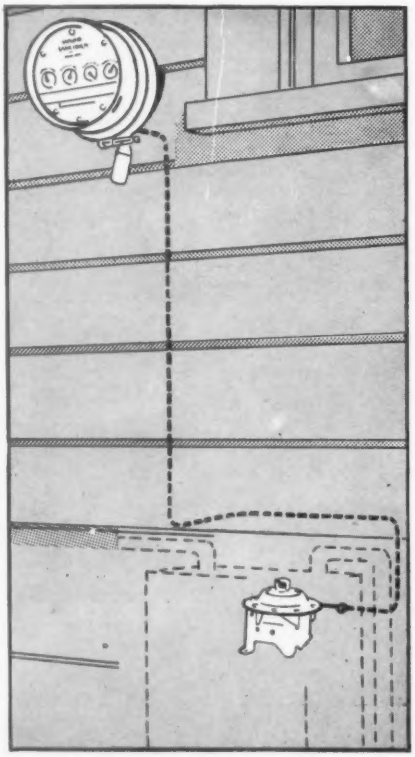
We thought this figure was a little high too—so we decided to do some checking. The results aren't in yet, but you'll have to admit, it's an alarming figure.

It's especially alarming when you consider that these men didn't have to go this way. It all could have been avoided.

You see the Sangamo Electric Company has a new device which installs on the regular tin meter and brings the gas meter reading outside the house.

With the meter reading outdoors, the meter reader never has to enter the house. He's never exposed to the terrors of the average basement. No booby-trapped staircases, no lethal clotheslines, no provoking search for the elusive meter. And no tracking in mud to upset the lady of the house.

We wrote everything down we thought you'd like to know about Telemeters and had it published under the title, "Outdoor meter reading is here..." or Bulletin 802. We've reserved a copy for you, so write for it today.



it's easier to get the reading ON THE OUTSIDE!

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

GT56-1

memo:

letters to the editor

Our Popular Handbook

Sirs:

Bouquets to you for your fine journal. Would like to have an additional copy of the handbook for a personal copy.

W. L. Youmans
Consumers Power Company
Saginaw, Michigan

. . . we need another one (American Gas HANDBOOK) . . . appreciate your advising how we might obtain one.

H. M. Logan, District Manager
Rockwell Manufacturing Co.
Tulsa, Oklahoma

. . . we would like to obtain two copies (of American Gas HANDBOOK).

W. R. Wise, Manager & Engineer
Commissioners of Public Works
Greenwood, South Carolina

. . . please advise if any additional copies are available and what procedure necessary . . . to secure one or more copies.

F. J. Linquist
Coltexo Corporation
Houston, Texas

Ed note: American Gas HANDBOOK is available only with subscriptions to American Gas Journal, because it is AGJ's 13th issue each year and postal regulations prohibit sale of the HANDBOOK separately. A few extra copies are available on a first come-first served basis to new subscribers.

American Gas Fundamentals

Sirs:

. . . sometime ago you published a series of articles entitled "Gas Fundamentals." Also, a glossary of industrial terms. Have these been published in book form? If so . . . please advise if available.

R. D. Smith,
Washington Natural Gas Company
Seattle, Washington

Ed note: The original American Gas Fundamentals series was concluded some months back. A new series, in which all previously published chapters will be revised and brought up-to-date, plus much additional information, will be published soon. The first chapters, which will be devoted to a comprehensive gas industry glossary, will appear within two months.

NINETY•SEVENTH YEAR

AMERICAN Gas Journal

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James A. LeVelle
Engineering Editor
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Assistant Editor
C. R. Graham
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465 East Union, Pasadena 1, California
Donald M. Taylor
Gulf Coast Editor, JAckson 3-6346
2730 Rice Blvd., Room 236, Houston, Texas
Lewis V. Hohl
Eastern Representative, MUrray Hill 6-7232
52 Vanderbilt Ave., New York, New York
Leo T. Parker
Contributing Editor

•

Joe B. Woods
President and Publisher
Abbott Sparks
Vice President and Advertising Director
Frank H. Love
Vice President
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NEW YORK— John Wallace
52 Vanderbilt Ave., MUrray Hill 6-7232
CHICAGO— E. V. Perkins
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AMERICAN GAS JOURNAL, February, 1956, Vol. 183, No. 2. Published monthly (except November, then semi-monthly) by The Petroleum Engineer Publishing Company, 800 Davis Building, Dallas 2, Texas. Second class mail privileges authorized at Dallas, Texas. Executive and Editorial Offices at 800 Davis Building, Dallas 2, Texas.

Development of natural gas fields in Pakistan has provided the greatest "spur" in industrial development in that country's eight-year history. Proved reserves are now four trillion cubic feet in the Sui gas fields. Gas is now flowing through a $25,000,000, 400-mile pipe line from Sui to Karachi. Supply is sufficient and officials are considering sale of gas to neighboring India.

Chances of early approval by the Federal Power Commission on export of Canadian natural gas to the United States are pretty dim, Carl O. Nickle, Member of Parliament, said recently in an address to the Canadian House of Commons. Opposition by American gas suppliers in the Middle West is holding up the approval, Nickle said, but stated that the situation may improve in a year or two. The exports are needed to insure the success of the $350,000,000 Trans-Canada Pipelines gas line from Alberta to Eastern Canada.

El Paso Natural Gas Company, major supplier to the southwest and California markets, is entering the refining business. Company has announced a $20,000,000 expansion construction program in the El Paso area and purchase of two New Mexico refineries at a cost of about $2,000,000. Planned are two gas treating plants, a 240-mile pipe line to bring raw materials (natural gasoline, butane, propane) from the Permian Basin to El Paso, and modernization of the two refineries and an alkylation and blending plant to upgrade natural gasoline and other products that El Paso Natural produces.

Tennessee Gas Transmission Company is expanding its butane operations to meet needs of the expanding Petro-Tex Chemical Corporation's plant near Houston. TGT will build a 200-mile butane pipe line from the Corpus Christi area to Houston, build a $2,000,000 liquid gas separation plant and underground storage tanks for products of the plant. Barge, truck, and rail loading facilities are also planned on a nearby Houston ship channel site.

Improvements and Expansions. Southern Counties Gas Company expects to add 68,000 new meters to its system in 1956. The company has budgeted $19,645,000 for plant improvements in the coming year . . . New York State Natural Gas Corporation plans to spend some $8,000,000 in 1956 on improving and expanding its facilities . . . Baltimore Gas & Electric Company plans to spend some $36,975,000 in the next five years on its gas distribution system . . . Public Service Company of Colorado plans to spend $5,900,000 on expansion of its natural gas distribution system in 1956 . . . Peoples Natural Gas Company plans to lay out around $7,200,000 during the year on bettering facilities in Pittsburgh and western Pennsylvania.

Oklahoma customers of Consolidated Gas Utilities Corporation will be paying more for their gas, but not much. The Oklahoma Corporation Commission has approved an increase in rates that will give CGU an annual increase of about $402,000. Users will pay 25 cents more for the first 1000 cu ft, 18 cents more for the next 2000 cu ft, and 6 cents per 1000 cu ft over previous rates for the next 7000 cu ft. The increase allows a 6 per cent rate of return on a depreciated original cost rate base.

MUELLER®

Sizes ¼"and 1"
Pressures to 1200 p.s.i.

No-Blo® Steel Valve. For high pressure service lines. Machined from steel forging. Available with threaded or welding inlets and outlets. "O" rings around stem and in cap prevent leakage to the outside. Metal to metal line contact of stem and seat assures gas-tight shut-off. The No-Blo Steel Valve can be completely reconditioned under full line pressure without escape of gas by using the Mueller E-4 Drilling Machine and gate valve. Easily operated from above ground through curb box.

POSITIVE CONTROL at the curb

Inverted key curb stop

Positive shut-offs are assured with precision ground key which is individually lapped into the stop body. This assures pressure tightness at the port and prevents leakage through the stop when closed. Key is firmly seated with spring pressure and line pressure. "O" ring seals at top and bottom of key prevent leakage to outside. Light down pressure on shut-off rod unseats key for easy turning. A wide selection of inlets and outlets will easily adapt it to any type of service line.

Sizes ¼"through 2"
Pressures to 125 p.s.i.

Contact your Mueller Representative or write direct for complete information.

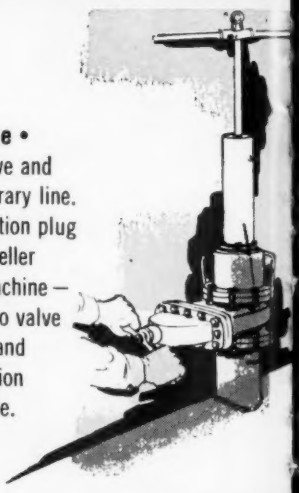
NO-BLO®

MUELLER CO.
Dependable Since 1857
MAIN OFFICE & FACTORY DECATUR, ILLINOIS

STEP 1 – Weld • Position and weld nipple to line or tank. Remove inner completion plug, attach test cap and pressure test. Remove test cap and attach and open Mueller gate valve.

STEP 2
Make cut • Attach C1-36 power driven Drilling Machine to gate valve and make cut. Close gate valve, remove drilling machine and attach temporary line.

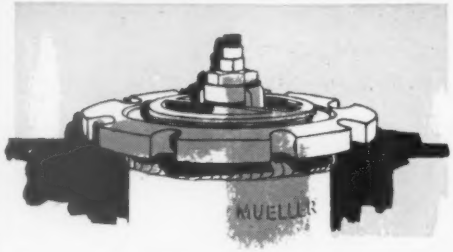
STEP 3
Abandon line • Close gate valve and remove temporary line. Attach completion plug to shaft of Mueller Completion Machine – bolt machine to valve – open valve and screw completion plug into nipple.



Recover valves from temporary connections

Mueller Save-A-Valve Drilling Nipples permit you to recover the gate valve when abandoning temporary connections. The exclusive No-Blo® Completion Plug with "O" ring seal and pressure equalizing valve is inserted into the drilling nipple through the gate valve. Screwed tightly into inside threads, the completion plug holds the pressure – permits you to recover the valve for other uses. A flanged completion cap provides a double seal against leakage. The flanged type nipple has a welding inlet contoured to fit the pipe. Available in sizes 4", 6" and 8" with 150 pound flanges for pressures to 230 p.s.i. Optional 300, 400 and 600 pound flanges on the 4" and 6" sizes withstand pressures up to 1200 p.s.i. Smaller nipples in sizes ¾" through 3" are available with welding or threaded inlets – pressures to 1200 p.s.i.

STEP 5 – Cap nipple • Tighten plug with wrench provided. Place gasket in flange recess of nipple. Bolt cap tightly to nipple. Recovery of gate valve is now complete.



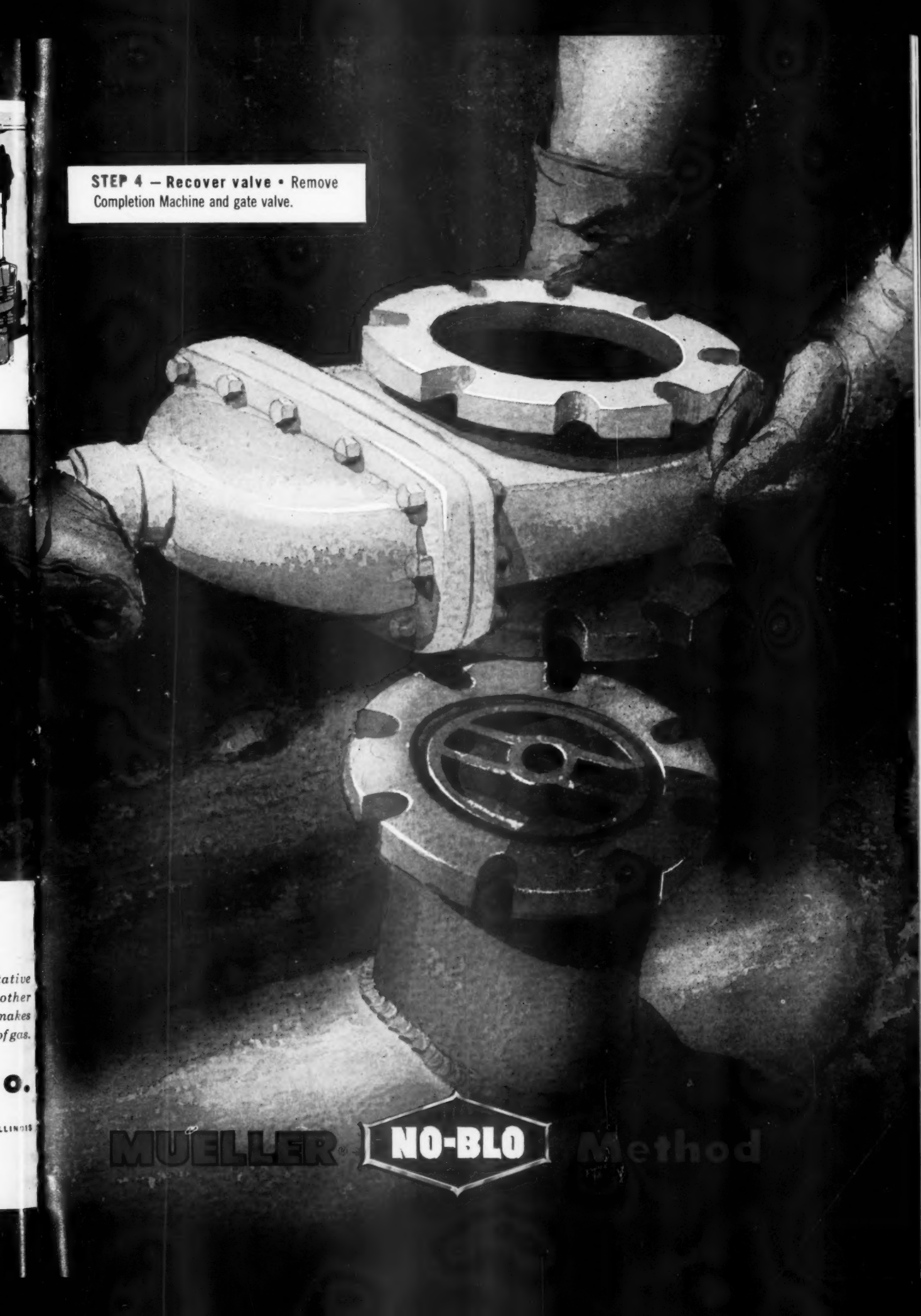
STEP 6 – Re-use fitting • Remove cap and loosen plug with wrench. Attach extracting tool to plug. Bolt gate valve to nipple and completion machine to valve. Advance shaft to engage extracting tool – unscrew plug and remove through gate valve. Close valve, remove equipment and attach temporary line.

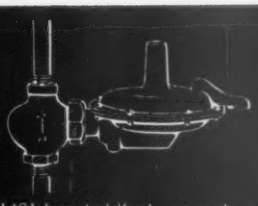
Contact your Mueller Representative for additional information on other Mueller No-Blo equipment that makes connections safely, without escape of gas.

MUELLER CO.

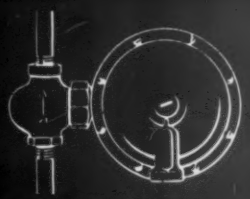
Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

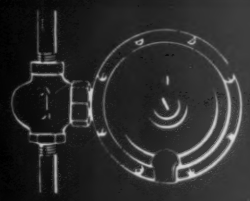

STEP 4 — Recover valve • Remove Completion Machine and gate valve.
MUELLER®
NO-BLO
Method



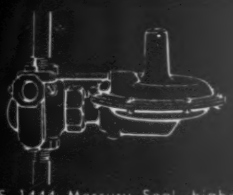
SERIES 1401 Inverted Vent—prevents collection of foreign material . . . screened.



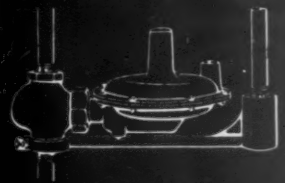
SERIES 1402 Vertical Diaphragm—Vertical Vent—large area screened vent prevents collection of water or foreign material on diaphragm.



SERIES 1403 Horizontal Vent



SERIES 1444 Mercury Seal—highest safety because of location on regulator head. One vent for diaphragm chamber and seal.

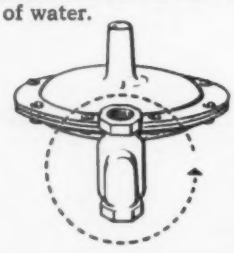


SERIES 1500 Meter Bar—available with 6 inch or 11¼ in. centers. Easily exchanged without disturbing meter

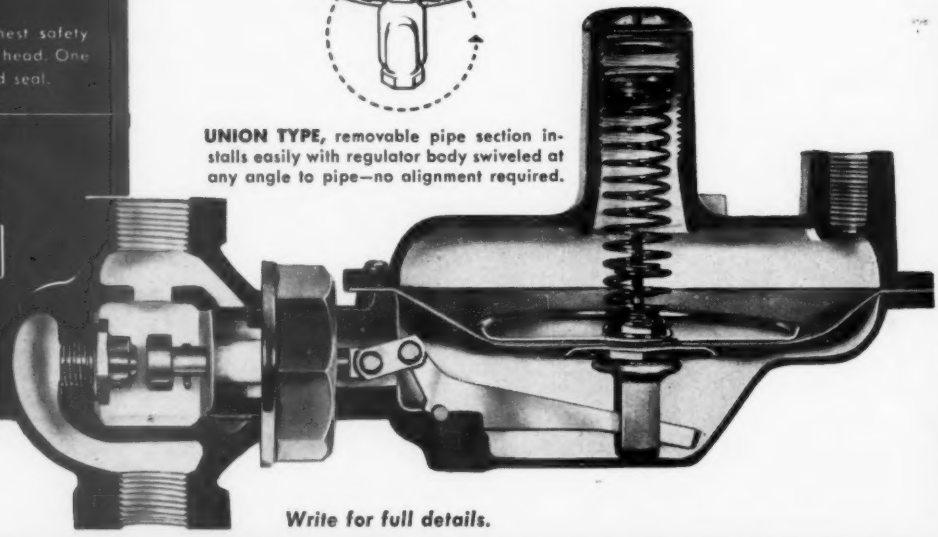
Meet Every Domestic Service Regulating Need with ... Series 1400 Reliance Regulators

NEW Safety, Accuracy, Economy

- **LARGE AREA PASSAGES** from the orifice to the vent outlet for emergency gas escape in case of excess pressure
- **STURDY NECK SECTION** helps assure efficient, smooth, compounding action.
- **FOR INLET PRESSURES** to 100 lbs. per square inch.
- **DIE-CAST** aluminum body and top.
- **RUGGED CONSTRUCTION**—no installation damage to exposed parts.
- **BUILT-IN** mechanical relief valve set to relieve at 14 inches of water.



UNION TYPE, removable pipe section installs easily with regulator body swiveled at any angle to pipe—no alignment required.



Write for full details.

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Boston • Chicago • Dallas • Denver • Erie • Houston
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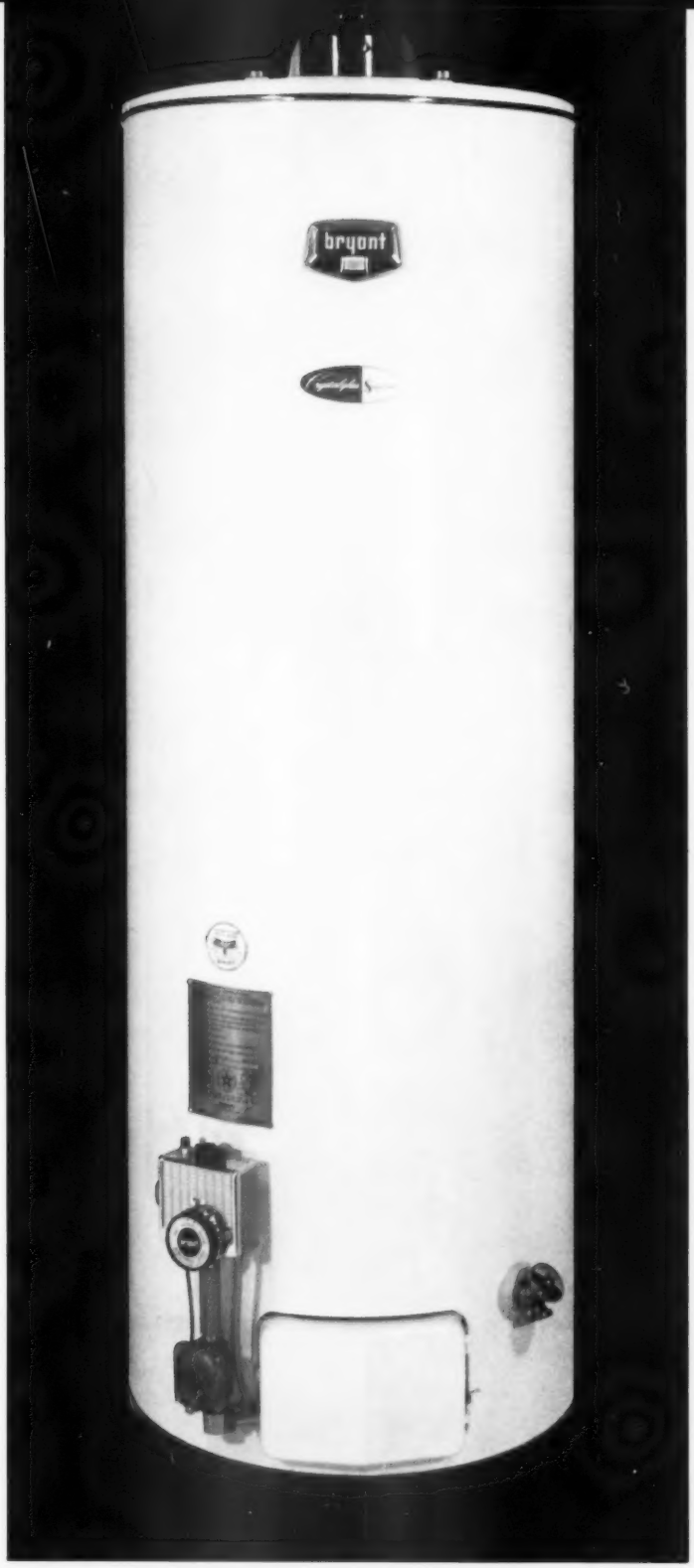
AMERICAN METER CO. EST. 1836 MEASUREMENT ENGINEERS

AMERICAN METER COMPANY



GROW BIGGER WITH **bryant**

and here's one way you can

GROW BIGGER WITH bryant

Sell the Finest Line of Water Heaters Built Today

The Bryant Water Heater sells easily and quickly because these beautiful, efficient *Crystalglas* models give your customers:

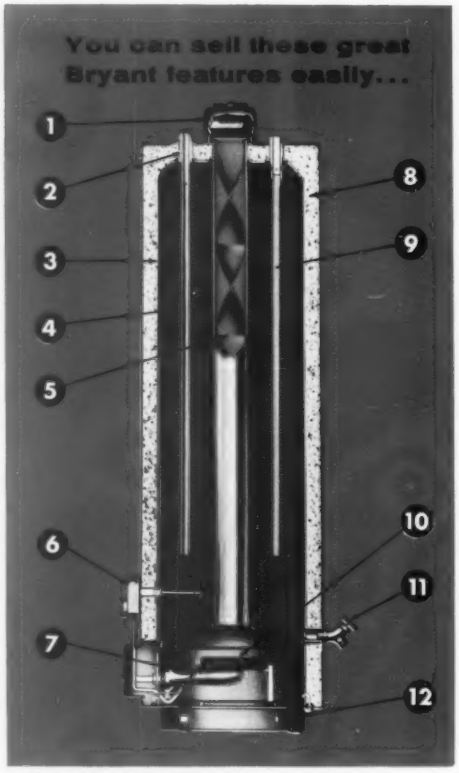
- Bryant "Horizon-Heat" Burners that provide a faster hot water recovery rate.
- A size for every requirement.
- 100% safety thermostat on all models.
- Truly low-cost operation

. . . and many other features (see right).

It's a Line Backed with Powerful Local Promotions

- A tremendous, sure-fire, complete dealer promotion.
- Complete sales promotion materials—newspaper ads, window display, store display, direct mail, etc.
- Personal assistance from your own Bryant, on-the-spot distributor.

Bryant is Growing Faster with the Finest Quality Line of Water Heaters Built. Get Full Details from Your Bryant Distributor, Today.



1. Draft Diverter—Bryant exclusive. Compact design.

2. Water Connection Fittings—Solid brass.

3. Heavy, Glass-lined Tank.

4. Dip-Tube—Introduces cold water at bottom of tank.

5. Center Flue—Equipped with Bryant "Twist-N-Turn" baffle.

6. Thermostat—Controls water temperature at desired point.

7. Pilot—Target-type for efficient operation.

8. Thick Glass Fiber Insulation.

9. Bryant Protect-O-Rod—Gives additional "stand-by" protection.

10. "Horizon-Heat" Burner—New, radial type to provide faster water heating.

11. Drain Faucet—At lowest point of tank. Solid brass for added protection.

12. Recessed Pedestal Base—Low in height; sturdy, one-piece construction.

and here are 8 MORE reasons why you'll GROW BIGGER WITH BRYANT

1. Your customers know and trust the name Bryant . . . famous for 47 years as the leading name in home comfort. That's why a Bryant is easier to sell.

2. From small home to mansion, or for store or factory, there's a Bryant to fit the budget and the need in gas or oil furnaces, boilers, air conditioners, space heaters, unit heaters, water heaters.

3. You build customer confidence when you install Bryant . . . the highest quality heating, cooling and water heating equipment made.

4. You profit more with Bryant because of the Bryant Business Development Program, the most complete program in the industry.

5. You get *sales building tools* that increase your sales and profits.

6. You have the help of a nearby Bryant distributor who gives you *complete engineering, sales and service help.*

7. You are backed up by *powerful national advertising* designed to help you.

8. You are given the most complete *co-op advertising to build sales in your own community* offered by any manufacturer in the industry.

Don't miss Bryant's big Water Heater Trade-In Promotion. It will get you the cream of the water heater business in your community. And get the full details of why it will pay you to grow bigger with Bryant. *For the name and address of your nearest Bryant distributor, write, Bryant, 48 Monument Circle, Indianapolis 4, Indiana.*

and GROW BIGGER with bryant

The Law:

Recent Decisions Change Some Laws Affecting Employee Compensation

By Leo T. Parker
Attorney at Law

Recently, the higher courts rendered many new and outstanding decisions affecting gas corporations. Several of these new decisions reverse the older law. This column will briefly review the cause and outcome of these cases with explanations designed and intended especially to a assist readers to prepare now to avoid future expensive law suits.

First is an answer to a very important legal question presented sometime ago by an official of a large gas corporation. He asks whether or not an injured employee can sue for damages, instead of accepting compensation allowed by the State Workmen's Compensation Act. A recent higher court decision on this subject of law will answer his query.

It is important to know that in some cases, employers have for many years paid premiums for state industrial insurance and yet heavy damage allowances, amounting to thousands of dollars, were awarded by the higher courts to injured employees, and in some instances in addition to the compensation allowed under the State Compensation Laws.

It has not been the intentions of any state Legislature, when enacting State Compensation Laws, to permit injured employees to recover excessive damages from their employers, or damages in addition to the lawful compensation.

Generally speaking, if employers understand and abide by state compensation laws they have ample protection against high damage allowances, and employees must accept reasonable amount of compensation specified by the state laws.

On the other hand, failure of officials of gas corporations to strictly follow these various state laws very frequently forfeits the legal rights of the corporation to compel the injured employee to accept specified reasonable compensation, instead of sueing for heavy damages.

For example, various state laws provide that in the event the corporation carries state insurance and fails to post notices thereof no employee "shall be deemed" to have accepted the provisions of the workmen's compensation law, and therefore the employee may decide to either accept compensation under the State Workmen's Compensation Law or sue the employer for damages.

For illustration, in *Jeume v. Del E. Webb Construction Company, 265 Pac. (2d) 1076,* decided recently, it was shown that after an employee was injured, he signed and executed the usual claims for compensation and medical benefits that were filed with the State Industrial Commission.

Several weeks after the filing of the claim the employee interviewed his attorneys. Thereafter he decided to sue his employer for damages, instead of accepting compensation provided by the State Workmen's Compensation Act.

The employee contended that he had this privilege because the employer failed to post or tack on the walls in his main offices, the insurance notices furnished by the State Industrial Compensation. However, as the employee failed to positively prove that the employer failed to post these notices, the higher court held that the employee could not sue for damages but must accept the compensation allowable by the State Workmen's Compensation Act. This court said:

"Appellant (employee) having failed to prove that the notices were not posted, is not entitled to maintain a common-law action of negligence in this case."

Nevertheless, this higher court clearly explained that if testimony had proved that the employer had failed to post the insurance notice on the conspicuous walls of his office, as required by the laws of the state, the employee could have sued and recovered heavy damages, instead of accepting relatively small compensation allowed the employee under the State Workmen's Compensation Act.

With respect to allowances of damages by juries for injuries to employees who, for some reason are permitted to sue the employer for damages instead of accepting compensation allowable and specified by the State Workmen's Compensation Act, here are reviews of several cases:

Recently a higher court awarded $32,000 damages to an employee who injured his hand. See *Hudgins v. Gregory, 219 Fed. Rep. (2d) 257.* The testimony showed these facts: One, Gregory so injured his hand that it was necessary to amputate the thumb and index finger. Due to fact that the employer had violated certain regulations Gregory brought suit to recover damages for these injuries.

The jury awarded Gregory $32,000 damages and the higher court approved the verdict, saying:

"There is no merit in the owner's (employer's) contention that the verdict of $32,000 is clearly excessive and without basis in fact. The record shows that the injuries suffered by Gregory have caused a 75 per cent loss of use of his left hand. His life expectancy is 37 years. In short, we think the record as a whole contains ample evidence to support a verdict of $32,000. While this amount may, at first blush, seem excessive, we cannot say it was so arbitrary as to show passion or prejudice on the part of the jury."

The statement of the court in this case, discloses a reason why damage allowances in a lump sum appear to be far in excess of compensation awards under the State Workmen's Compensation Act. The court allows damages based on the injured person's loss of income during the remainder of his life.

For comparison, see following late higher court decisions:

In Meloy v. Texas, 263 Pac. (2d) 879, it was shown that an employee was injured which interferred with his ability to walk normally. He sued his employer for damages. The higher court awarded the employee $65,000 damages.

In *Wills v. Mex. 264 S. W. (2d) 518,* a jury awarded $82,000 damages to a 29-year-old employee who suffered compound fractures of his shoulder.

In *Cameron v. Evans, 62 N. W. (2d) 793,* the higher court allowed a person $21,000 damage for a partial disability spine injury.

In *Stanford v. Freight, 117 Fed. Supp. 903,* the Federal Court awarded an employee $150,000 for injuries which paralyzed his legs.

In *Chambers v. Tobin, 118 Fed. Supp. 555,* the higher court allowed $30,000 damages to an employee for a permanent injury to his arm.

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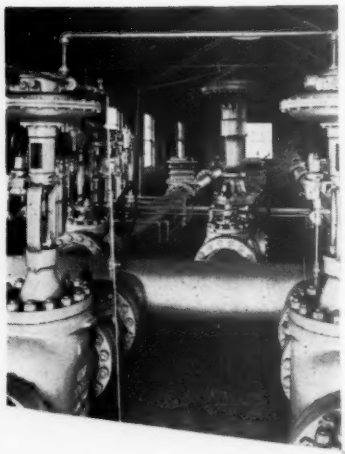
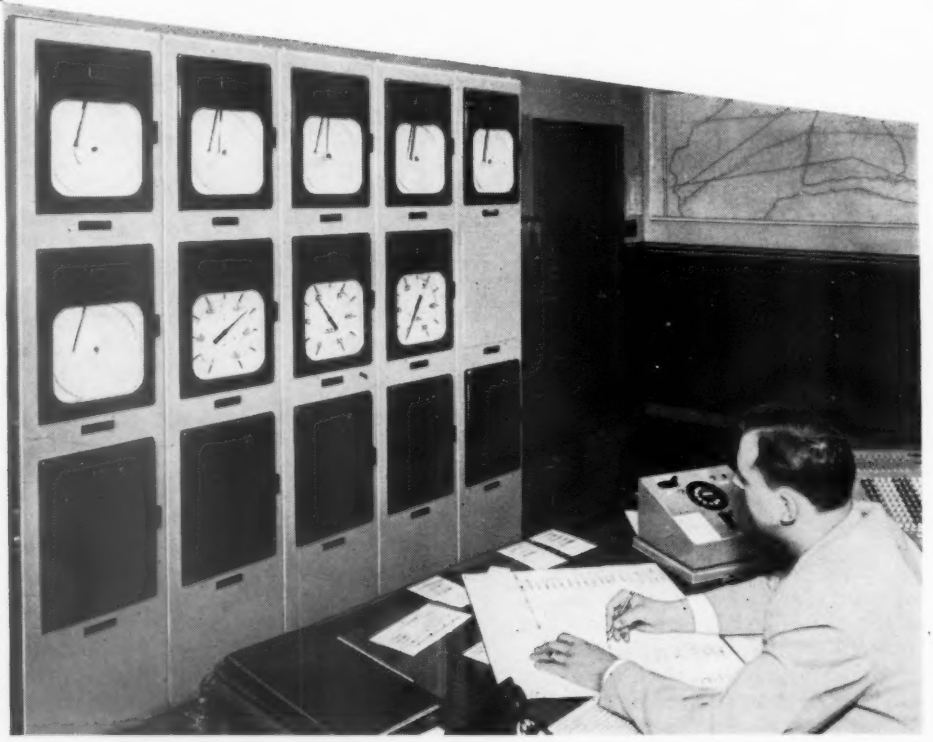


Algonquin Gas Transmission Company reports:

Bell System channels for telemetering help boost both sales and service

At the right is a view of the dispatching center of the Algonquin Gas Transmission Company in Boston. Above is shown one of the company's metering and regulating stations.



Load shifting by remote control, made possible by Bell System channels for telemetering, is helping increase sales and improve service for the Algonquin Gas Transmission Company.

This company supplies natural gas at some 39 delivery points to 23 different utilities throughout the New England states.

Because the Algonquin dispatcher has a running check on pressures throughout the system, he can constantly shift the load, thereby insuring the maximum flow of gas through the pipe at all times. This means increased sales and extra service for satisfied customers.

In addition to the constant check between anticipated demand and actual load conditions, Algonquin's system-wide telemetering has other benefits—instant detection of threatened freeze-ups and line obstructions—maintenance of predetermined pressure for each customer—thorough knowledge of conditions on the entire pipeline system.

. . .

Modern communications save time, cut costs, improve service. A Bell System communications engineer will be glad to survey your company's needs. There's no obligation. Why not call your Bell Telephone representative today?

BELL TELEPHONE SYSTEM

TELEPHONE TELETYPEWRITER TELEMETERING AND REMOTE CONTROL CHANNELS

FUEL FOR THOUGHT

agj editorial summary

NOW IS THE TIME . . .

to think about promoting gas air-conditioning sales.

It won't be too long until the warm spring and summer months are here. More and more homeowners are thinking about air-conditioning their homes. The same is true for the owners and operators of many large commercial buildings that are not now "cooled in the summer."

The best time to build that summer load is long before you need it.

There are many good gas air conditioning units available now. They can provide more than ample competition for other types of air conditioning equipment.

But they will have to be sold.

And the task of selling potential air conditioning customers on gas units will require large amounts of both inspiration and perspiration.

Aggressive promotion on the part of the utility companies, in cooperation with local dealers and distributors and installation firms, is vitally needed.

All forecasts point to a tremendous growth in air-conditioning of all types.

Why not get out and start fighting for the lion's share . . . ?

The time is now.

NO STORAGE OR DELIVERY PROBLEMS

Sometimes, if you are cold or don't have hot water for the ordinary daily tasks such as bathing, washing dishes, and laundry, it might be worth a few dollars or so to make these necessities available.

The recent strike of deliverymen in New York — who deliver fuel oil and coal — makes us wonder if the users of fuel oil and coal weren't a bit envious of their neighbors who are taking advantage of gas and all its advantages?

Those people who found their supplies low . . . the oil tank about empty or the coal bin about bare . . . might have found consolation in long underwear and extra blankets.

How much better, though, to just turn on the gas valve and know that it is always ready to provide clean, instant heat?

For gas is always there . . . ready to serve.

Cooking to Air Conditioning

Gas Does Everything Better In Dallas' New STATLER HILTON

Three 380-hp gas fired water tube boilers supply steam for the hotel's many uses: refrigeration, heating, cooking, baking, hot water, laundry.

Bruce Cunningham
Lone Star Gas Company

FROM TOP TO BOTTOM, IN THE MAGnificent new 20-story Statler Hilton Hotel in Dallas, natural gas is playing a major role in providing the ultimate in comfort and convenience for the hotel's guests. Gas is an ever-present servant in the mammoth service operation, providing year-around air conditioning, cooking, hot water, laundry, and many other needs on a 24-hour schedule.

Located in the hotel's basement, kitchens, bake shop and laundry are over 100 pieces of equipment, either directly gas-fired or operated by gas-generated steam, ranging from mammoth broilers to deep-fat fryers and from clothes dryers to bread toasters. All combustible trash accumulated in the hotel is burned in a giant gas incinerator.

Annual fuel requirements for all these services will total an estimated 212,000,000 cu ft. Some 205,000,000 cu ft will be used annually to generate steam for air conditioning, heating, and hot water. Another 7,000,000 cu ft

Main Kitchen. Batteries of heavy duty gas ranges, ovens, deep fat fryers, and broilers are used to turn out food easily and quickly.

will be used for the hotel's vast cooking operations.

The $16,000,000 hotel will have facilities to serve food to approximately 3000 guests and employees at one sitting in the numerous dining areas and function rooms — a total of 9000 meals per day.

The culinary centers — kitchens and bake shop — are equipped with some 80 gas or gas-generated steam units for cooking food, sterilizing dishes and utensils, and to retain heat in foods ready to be served.

Additional hundreds of meals are delivered to guests each day through the hotel's room service, one of the busiest phases of the food and beverage department.

King-sized Kitchens

The Statler Hilton operates three kitchens where sparkling gas appliances with automatic features match the spick-and-span appearance of several hundred culinary experts under the direction of Head Chef Anthony L. Cominotto. The main kitchen services the Coffee House, the Empire Room, the Grill, and room service meals.

A second kitchen prepares food served in the Grand Ballroom, the Embassy Ballroom and five function rooms named the Blue Bonnet Room, the Mustang Room, the Silver Room, the Gold Room and El Corralito.

The third kitchen services a cafeteria made available by the hotel for the exclusive use of its staff of 1000 employees.

The main kitchen, where most of the food is prepared, covers approximately 11,000 sq ft. To handle cooking chores in this kitchen, batteries of gas ranges turn out general-purpose cooking on top of the stoves and broilers put a live flame to steaks, chops and fish to bring out flavor. A combination charcoal and gas broiler adds an "outdoor" touch to steaks.

Stacks of prepared dishes are kept warm by steam which circulates throughout batteries of enclosed cabinets. King-size aluminum steam kettles are used in cooking soups, turkeys, beans and stews. One of these mammoth cookers can accomodate as much as a dozen turkeys at one cooking. Vegetables are cooked in numerous triple-deck steamers.

Deep-fat fryers put a golden brown to chicken and fish. Bread toasters, salamanders for broiling and retaining warmth in food, double-deck roasting ovens, and 15 gal capacity coffee urns complete the gas equipment in the main kitchen. In addition to the standard gas cooking units the banquet kitchen is equipped with a gas-generated steam warming oven with a capacity for 500 meals served up on plates. The hot food is delivered to the various dining rooms by means of double-deck push carts.

The main kitchen is strategically located in close proximity to both the Grill and Empire Room so that guests may be served the hot food quickly. The layout also provides for production-line efficiency in preparation of food. Meats, vegetables, fruits and other raw materials come in from the outside, are stored temporarily, then passed through the kitchen as chefs and cooks prepare the menus for the day. At the other end of the kitchen, the finished meals go out to the dining rooms.

Built-in Bakery

A bake shop adjoins the main kitchen. In line with Statler Hilton's policy of self-sufficiency, the bake shop makes all breads, rolls, pies, cakes and other "goodies" served hotel guests. Equipment consists of three double-deck gas ovens turning out 1000 rolls in one baking. A triple-deck steamer cooks fruit and custard pie fillings at

Bakery and Pastry Shop. Three sets of double-decked gas ovens are capable of turning out over 1000 rolls in a single baking. All breads, rolls, pies, cakes and other pastries are made here.

fast and accurate temperatures so important in this operation. A gas "proof" oven raises uncooked bread and rolls to complete size prior to baking in the big gas ovens. A deep-fat fryer turns out hundreds of doughnuts daily.

The Statler Hilton kitchens reflect perfection in cleanliness and sanitation — a "must" order during any hour of the day or night. Dishwashing in the hotel has been made as mechanical as possible. Dishes are carried from the main dining room to the dishwashing area on a conveyor belt and then travel along another belt, 18 ft in length, through a dishwashing machine. As they pass through the mechanical dishwasher, after being sorted, scraped and prewashed, the dishes are thoroughly cleaned and sterilized by gas-generated steam at a minimum temperature of 180 degrees. The dishes are dried by steam heated hot air pouring over them.

The banquet kitchen and the main kitchen are equipped with separate dishwashers, each turning out approximately 10,000 clean and sterilized dishes an hour. A similar operation is conducted in the employee cafeteria kitchen. Glasses are cleaned and sterilized by steam in separate washers.

Laundry Facilities

All of the 1001 hotel rooms have Servidor service — guests' laundry and garments for cleaning and pressing may be placed in the room door and picked up from the hall without disturbing guests. These articles of apparel along with the hotel's sheets, pillow slips, towels and other linens are cleaned and pressed in a fully equipped laundry in the hotel basement.

Seven rotating vats holding clothes

Cleaning and Sterilizing Machine is standard equipment in kitchens for all dinner glasses. Gas-generated steam provides the "punch."

Mammoth warming room retains heat in cooked foods served at banquets. Heat is provided by gas-generated steam.

Linen Dryers, left, and rotating washing machines, right, use steam and hot water generated by the gas fueled boilers.

Steam operated mangles and pressers complete the laundry, which is entirely self-sufficient.

weighing from 50 to 350 lb per load, perform the washing chore. Wash water in the vats reaches a temperature of 130 degrees. The clothing goes through gas dryers, is ironed by huge mangles, each with capacity to turn out 700 sheets an hour. Towels and other fuzzy articles are fluffed in tumblers before ironing. A battery of 10 steam pressers turns out suits and coats.

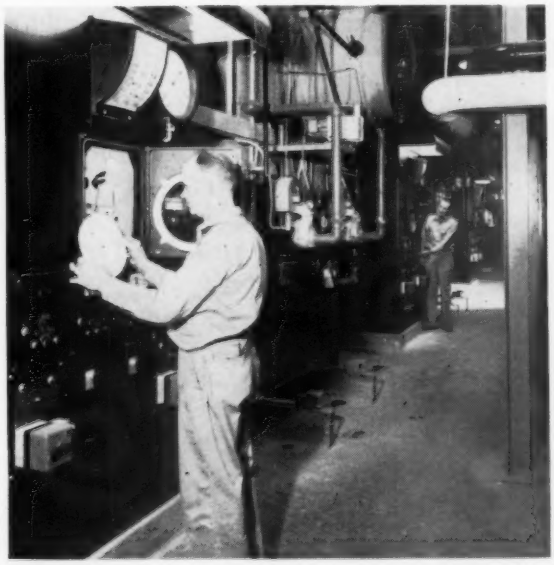
Air-Conditioning Facilities

A year-round gas air-conditioning system with cooling capacity equivalent to melting 2,800,000 lbs of ice every 24 hours provides "man-made" climate throughout the new hotel.

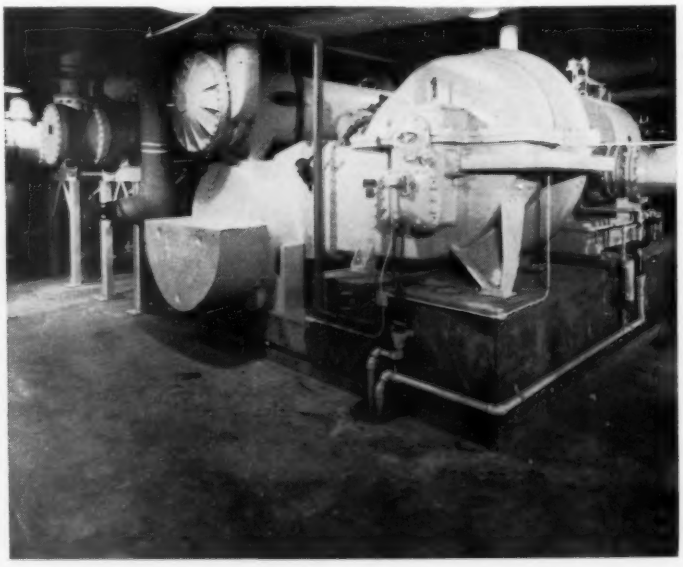
Individual control units in each of the 1001 guest rooms permit selection of temperature desired. Temperature and moisture content is also thermostatically controlled in dining rooms, restaurants, meeting rooms, shops, stores and employee locker rooms to produce the comfort conditions required at any given time by the occupants.

Halls and corridors in the hotel proper receive the excess conditioned air which has not entered the guest bathrooms. The fresh outside air comes directly to a room and then goes directly outdoors through an exhaust air outlet on the wall of a bathroom. The volume of intake being slightly more than the volume of air exhausted, the excessive amount of air finds its way to the corridors through the undercut guest room doors.

The engine room, kitchens and basement laundry are also comfort conditioned. Intakes pull in filtered fresh outside air which is circulated throughout the areas and removed by mammoth exhaust fans. The fans remove excess heat and food odors which might emanate from the kitchens.

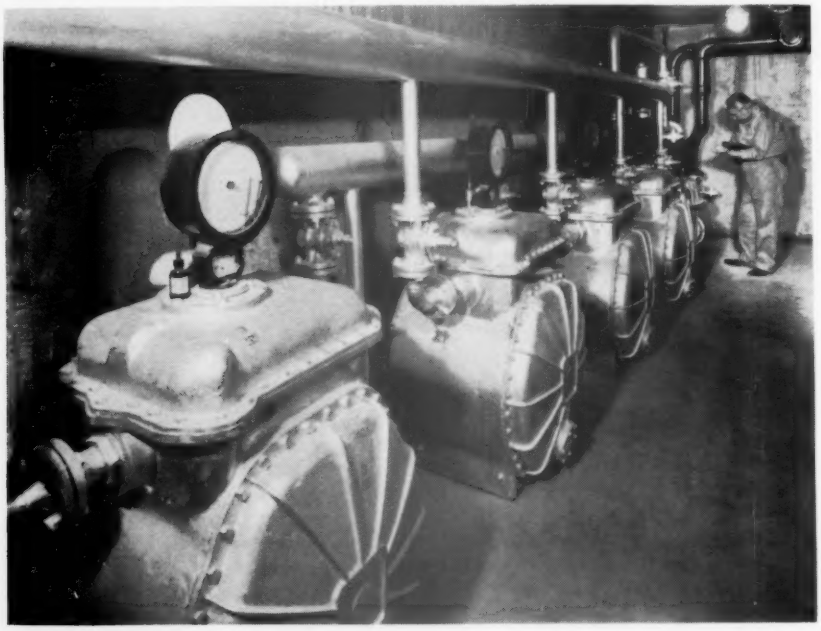


Boiler control board. Each of the three gas-fired boilers has capacity of 25,000 pounds at 250 psi. All operation is completely automatic except for the routine of changing charts.

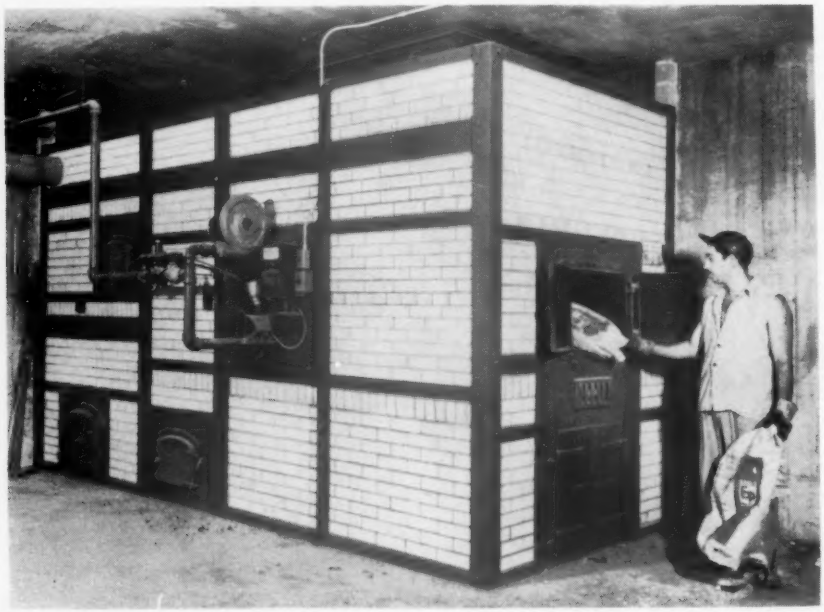


Two 753-hp steam turbine-driven, centrifugal refrigeration units produced chilled water for hotel — which in the summer will require approximately 1400 tons of air conditioning.

Year around air conditioning is feature of all guest rooms. Individual control units permit selection of temperature desired.



Battery of five industrial and commercial meters registers gas load delivered by Lone Star Gas Company. Some 212,000,000 cu ft will be consumed annually.



Giant gas-fired incinerator burns all combustible trash that accumulates in new hotel.

Approximately 1400 tons of air conditioning capacity are required for the summer cooling of hotel guests, employees and personnel and customers in the stores and shops. Total air conditioned area covers practically all of the hotel's 6,145,000 cu ft of space, including a mammoth meeting room that can accomodate 2200 persons.

Equipment

The 20-story hotel is cooled by two 753-hp steam turbine driven centrifugal refrigeration machines. Three 380-hp gas-fired water tube boilers produce steam to drive the turbines operating the refrigeration machines.

In winter, the boilers provide hot water for heating the building. Each of the three gas boilers has capacity to generate 25,000 lb of steam per hour under 250 psi pressure.

Heart of the air-conditioning system is comprised of the two 753-hp steam turbine-driven centrifugal refrigeration machines. Two giant pumps circulate chilled water throughout the hotel to produce the necessary cooling results.

The air-conditioning cooling tower is located on the hotel roof. The tower is 20 ft high, 27 ft wide, 50 ft long and will cool 5200 gal of water a minute. There are 61 fans in the air-conditioning system, ranging from one that can move 826 cu ft of air a minute to one about the size of a B-36 engine that can move 61,000 cu ft a minute.

Nine men operate the system under the supervision of D. D. Stevens, building superintendent and chief engineer for the Statler Hilton. Engineers and boiler operators are on duty 24 hours a day in the engine room, and maintenance engineers keep the individual air-conditioning temperature control units at peak performance. * * *

Equipment Used in Hotel

Gas Appliances

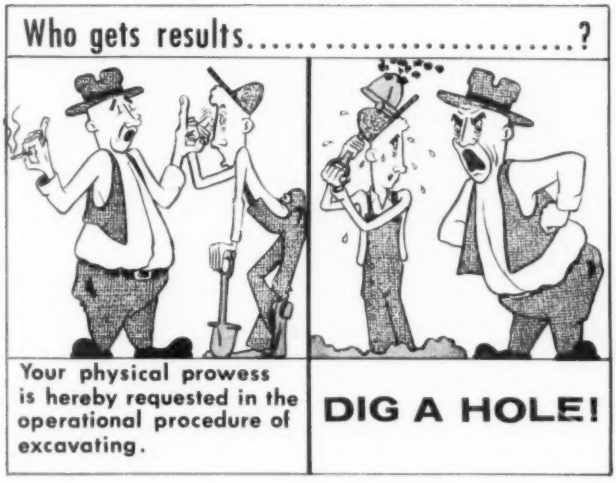
Boilers	Erie City
Burners	Webster Engineering Co.
Incinerator	Washburn & Granger
Incinerator Burner	Johnson Appliance Co.
Bake Ovens	Martin Company
Ranges	Garland
Toasters	Savory Toaster Co.
Deep Fat Fryers	Pitco Fryolater Co.

Steam Equipment

Turbines, Feed Water Pumps	Copus
Turbines, Air Conditioning	Terry
Convertors	Patterson-Kelly
Dish and Glass Washers	Colt Autosan Co.
Laundry Dryers, Ironers	American Laundry
Steam Kettles	Hobart
Heating Coils	Aerofin & Buffalo Forge

Third of a series

Dennis Murphy



Communication:

words resemble people— they're our employees!

COMMUNICATION is a matter of word-management. Since words are our workers in this eternal process, we ought to learn all we can about them—their kinds, duties, effects, and how they are managed. We have to make sure that we employ the right words and that they do precisely what we want done. What study, then, could be more useful toward business management or executive development?

Many a supervisor may know his work thoroughly but mismanage his communication by allowing words to loaf on the job, tyrannize over him, detract from his performance, and demoralize his thinking. Words are our living helpers, not dead entities, and each word has its individual traits and capacities. But we should learn to make each one do our exact bidding. Communication is a skill that requires precision, patience, and practice.

Since words are as different and changeable as people, whom they resemble in many respects, this article will try to suggest ways of managing words better as a means to managing employees better.

The Nature of Words

1. **Words are symbols to evoke something else.** Through print, script, or sound they refer to some concept, image, idea, or thing. The problem is to get a word to evoke the same thing in two minds at once. Because this is really impossible, we settle for a workable meaning. When two people agree on a common referent or meaning behind the word-symbol, communication can begin.

2. **Words have many meanings.** Since one word may have many referents, both the sender and the receiver must connect mentally on the intended meaning, the right meaning. "No, I don't mean that!" is a signal that either the sender or the receiver is off the track. If understanding is difficult between two persons, the difficulty increases with more persons involved. The miracle is that we have as good communication as we have!

3. **Facts are statements that can be verified.** Several examples are H_2O, 60 mph, 4:47 p.m., and "the square of the hypotenuse of a right triangle is equal to the sum of the squares of the two legs." Men and women, Russians and Americans, Jews and Gentiles, old and young—all accept scientific facts. Objective facts may result in writing as dull as a telephone directory, but people don't argue over them.

4. **Inferences are statements about the unknown.** They're made on the basis of the known, but error lurks here. We may draw a wrong or unwarranted inference from the data we have. In the chain of reasoning we may miss a link and conclude wrongly; or in testing the evidence we may misjudge. And so, while we feel comfortably just in making *our* inference, we may discover that the other fellow has arrived at an inference far different from ours.

5. **Opinions are judgments we form about persons, places, or things.** Usually they are sentiments arrived at from experience. Milton said that "opinion in good men is truth in the making," and we tend to accept the authority of men of position and leadership. But there's plenty of room for error here because all men make mistakes. As Voltaire said, "I don't believe a thing you say, but I'll defend to the death your right to say it." So, in all communication we must allow for difference of opinion and try to disagree graciously.

What's in a Word?

As to grammar, each word is called "a part of speech" that is always determined by what it does in a particular sentence. Thus *fast* may serve as a noun, a verb, an adjective, or an adverb—depending upon its use. This changeable function of words corresponds to the changeable title and function of workers in different firms.

As to nature, words resemble people by being primarily active or static. Verbs and nouns are active, even volatile; adjectives and adverbs are far less so. We can best infuse new

life into a sentence by giving the verb a blood transfusion. Verbs are the veins and arteries of the sentence. *Verb* comes from Latin *verbum*, meaning "word," and the Chinese call all verbs "live words." The verb is indispensable in the sentence; compare "Go!" with its more colorful brother, "Scr-r-am!" *Noun* comes from the Latin *nomen*, meaning "name." Specific verbs and nouns strengthen our sentence.

Many businessmen hope to improve their writing by using more adjectives and adverbs. This is a mistake; the opposite is usually true. In fact, an adjective often fights with its noun, as when the old pipeliner said, "I'm against any goddam profanity around here!" Thus "the heroine whispered" says as much as "the beautiful brave young girl spoke in a very low soft voice" and says it four times as economically. Words like *very* and *interesting* do little except clutter up the sentence. We should use adjectives and adverbs less often but with more care.

Key Words and Helpers

As to function, words may be classed as content workers and structure workers. In many ways they resemble line men and staff men.

1. **Content words**—main verbs, nouns, adjectives, and adverbs—are the "key workers" who carry the meaning and do the most important job. Roughly, of the 600,000 words in our language, about 80 per cent are content workers.

2. **Structure words** are the articles, auxiliary verbs, pronouns, prepositions, conjunctions, and some adverbs. They are usually short, simple, and familiar "helpers" that support and hold the content together, but they carry little meaning in themselves alone. All auxiliary verbs like *is, was, were* (all forms of *to be*), *shall, will, should, would, have, has,* and *had* are connecting tissue in our sentences.

Although structure words comprise only 20 per cent of our total words, 25 per cent of all adult writing consists of these ten structure words: I, you, we, a, the, and, for, to, of, in. To simplify writing, then, we need to watch the long content words—nouns, verbs, adjectives, and adverbs with many syllables.

What Do You Mean?

As to use, content words have two sets of meanings. One is the logical **denotation** found in a good dictionary; the other is the emotional **connotation** suggested by experience. The first gives the character; the second, the reputation of a word. The noun *cross* denotes two transverse wooden beams, but by association it connotes far more to most people. A seventeenth-century Englishman named Derrick devised a heavy scaffold for hanging criminals; to oilmen today *derrick* connotes something different.

Justice Holmes (245 US 418, 425) wisely wrote: "A word is not a crystal, transparent and unchanged; it is the skin of a living thought and may vary greatly in color and content according to circumstances and the time in which it is used."

Some employees, like the early Roman soldiers, are not worth their *salary* (salt money), and some employers do not live up to the denotation of their *company* (break bread with you). Most businessmen will be rewarded if they look up the history of words like *banker, broker, money, calculate, comptroller, amortize, panic, secretary, supervisor,* or *A-1*. Words, like people, are alive and fascinating because of their heredity, environment, and intrinsic worth.

If we could all agree to use only accepted definitions, communication would be much less liable to error and misunderstanding than it is. But no word ever has exactly the same meaning twice, and no word ever means exactly the same thing to any two people at a given time. Therefore, accurate communication is difficult because personal judgments, inferences, opinions, and prejudices keep creeping in. Words often say less than they suggest. For example, contrast "the crackpot politician sneaked in" with "the congressman with unusual views entered quietly." Both treat the same fact—but how differently!

Learning To Manage Our Words

Everything said so far is intended to encourage us to control words that do our daily work. Who shall be the master: we or our words? Nothing in life, unless it be our actions, reveals us more clearly than our language—that integral part of us that comes right out of our innate thinking, personality, and character. That's why word-management is so important to all of us and especially to businessmen.

We need to learn how to assign words in the best working order, to curb refractory ones that go beyond our authority, to quell those that monopolize every expression, and to cultivate others that deserve more employment. Maybe we need to evaluate some oldtimers we've put up with too long, and employ some vigorous new workers to improve our communication jobs.

Let's look at a few word-workers that are "problems."

Trite Words

Trite words are those so overworked that they no longer have any life, freshness, zip. The French call them *clichés*, meaning "stereotyped." Structure words—*a, an, the,* conjunctions, and prepositions—never grow hackneyed but content words do. Even bright and sparkling figures, through overuse, become washed-out and insipid.

A skillful manager of words tactfully avoids these drones because they never turn in a full eight-hour-day's work. Worn-out and commonplace, they're more excusable in daily conversation than in writing. But they put any manager in a hole by making him appear to be a rubber stamp given to tabloid thinking. Here are a few of them to avoid:

Lazy **Tired** **Bothersome** **Timid** **Pompous**

after giving due consideration
as soon as possible
assuring you of our cooperation
at this time we wish to state
at your earliest convenience
beg to advise and beg to remain
contents carefully noted
for your careful consideration
fully aware of the facts
in accordance with your request
in response to your kind favor
please be advised that
pursuant to your recent request
referring to yours of recent date
resort to drastic measures
thanking you in advance
too numerous to mention
your kind and esteemed favor

Pompous Words

Businessmen and others use big words because of habit, the desire to show off, or a misguided attempt to "improve" plain expressions. Some word-managers mistake pomposity for dignity, but Fowler in MODERN ENGLISH USAGE says "the better the writer, the shorter his words."

Sometimes a big word is the right one—if the subject calls for it, the receiver understands it, and the employer uses it correctly. Where everyone knows what *decentralization* means, for instance, we don't economize by writing *break up into smaller units*. But when big words for little ideas keep piling up, look out! We lose our reader. *Peruse* for *read, domicile* for *home, utilization* for *use* soon make him sick. Why make him beat his brains out on "subsequent regulations governing transportational procedures" when we can say "later rules for shipping"? Short words that are not highfalutin can say exactly what we mean and make our writing easy to read and understand.

The trouble with pompous words is that they make stuffed shirts out of us. They betray us. They alienate us from other human beings. They disgust our readers or listeners, causing them to doubt our sincerity, honesty, integrity—our character. Pomposity has cast a stigma on business writing that's going to take a lot of effort to erase.

Although the number is endless, here are a few pompous workers that have been deflated:

aggregation	— total
approximately	— about
assistance	— aid, help
commendation	— praise
commercialization	— commercial
customary channels	— usual way
effected, effectuated	— made, did
endeavoring, attempting	— trying
equivalent	— equal
functionalization	— use
instantaneously	— now, quickly
instrumentalities	— means, ways
involving, concerning	— about
procedural practices	— what to do and how to do it

Someone may aptly ask "Why increase our vocabulary if we shouldn't use any big words?" Often we need some unusual word and use it with propriety, but if we lug it in awkwardly it seems to shout "Look, I'm a big word you don't know!" We should enlarge our vocabulary to help us in reading and understanding, but our audience will determine how many big words are in good taste. Unfamiliar words work like a drug: harmless in small doses but deadly in excess. Flaunting our word-supply is like parading our wealth—and with much the same effect. It's more likely to depress than impress.

Superfluous Words

No manager would think of hiring twelve employees to turn out a job that four could do. Yet businessmen everywhere go on employing three or four times as many words as needed to do their communication job. Misers with money may be wastrels with words—an odd paradox because words are not cheap but expensive, sometimes costly. Unnecessary words are great loafers that clutter up work, usurp the most important position in a sentence, and create confusion.

it was the manager's contention	— *the manager contended*
there were no reports issued *by* the company	— *the company issued no reports*
there have been times when	— *sometimes*
there are many employees who go	— *many employees go*
is was then that we first learned	— *we first learned*
it is the belief *of* the president	— *the president believes*
there are some products *that* have	— *some products have*
there is a possibility *that* some *of the* employees	— *possibly some employees*

Superfluous words often gang up in pairs to appear strong and emphatic but play havoc with work simplification. Notice these doubles:

each and every man, woman, and child	— *everyone*
he, she, or it, as the case may be	— *he*
accordingly and consequently	— *therefore; so*
rules and regulations	— *rules*
first and foremost	— *first of all*
deeds and actions	— *acts*
fair, just, and equitable	— *just*
leases and lets unto	— *leases to*

Abstract Words

Vague blanket words are wishy-washy and indefinite. In pretending to cover everything, they cover nothing. They result from muddled thinking and the lazy habit of letting any old word do. They reveal a word-manager who's still "up in the air" and unable to get a close hold on his material.

Compare "Operations have been extended into this northern producing area by one of the petroleum transportation companies" with "Service Pipe Line Company laid 23 miles of gathering line near Tioga in the Williston Basin of North Dakota." Or compare "One of the company's representatives explained the nature and characteristics of the proposed facility and commented with respect to its installation" with "Mr. Willis, chief engineer of Fairbanks-Morse, described the dual-fuel engine and told how to install it."

We can't avoid all abstract words, nor should we. Words like *greed, fear, war, love,* and *success* are inevitable but should be made specific by details. One trouble with abstract words is that they're *not pictureful;* so they're hard for the reader to grasp because they don't give him enough concepts to prevent fatigue. Another trouble with them is that they're *not exact.*

Lack of exactness makes these words the most dangerous to use because they permit so much misinterpretation and misunderstanding. A general word like *tree* will mean twenty things to twenty people, whereas a specific word like *silver birch* will exclude a lot of trouble arising from different meanings. Mark Twain once said "the difference between the right word and the almost right word is the difference between lightning and the lightning bug."

Here's a list of abstract words that seldom get close to any idea:

concerns	capacities	conditions
affairs	properties	functions
activities	procedures	operations
relations	economics	changes
facilities	effects	systems

In fairness, we must admit that business writing may purposely be vague, general, or abstract. It's a trick of the trade. Why should one firm reveal specific details about its business when other firms don't reciprocate? Competition could be killed by such a practice. Revealing only what is proper, being noncommittal or evasive, and using general terms may result in poor writing—but mighty good business. Being secretive is necessary at times, but this recognized fact doesn't excuse most abstract writing.

Foreign Words

Technical writing calls for the precision of technical words, most of which are foreign. But a top-notch lawyer, doctor, engineer, professor, or any other learned man makes an affected ass of himself when he tries to advertise his learning through monstrous words. His audience should determine his usage; he may spout technical terms for others in his profession, but he should use a layman's language for the public.

A parade of foreign phrases will sabotage communication because our English language is quite adequate. Fowler says that "short words are not only handier to use, but more powerful in effect; extra syllables reduce, not increase, vigor. This is particularly so in English, where the native words are short, and long ones are foreign." But only about a fourth of our vocabulary of 600,000 words goes back to native Old English.

Legal jargon makes any plain writing sound stilted, obscure, and unnatural. A few of these offenders are *said, such, aforesaid, prior and pursuant to, thereof, therefrom, hereinunder, herewith, hereunto, wherefrom, wherewith,* and others like them. *Aforementioned, re, in re,* and *anent* are taboo. Anglicized plurals like *memorandums* and *campuses* are better than foreign plurals, and *data* is correct as a singular noun.

Per is Latin for "through, by means of." *As per, per books, per balance sheet,* and *per contract* are nonsense. It's better to say "an hour, a day, or a year" than *per hour, per diem, per annum. Etc.* is incorrect after *and* and redundant after *for example, such as,* and similar phrases. Even *viz., i. e., e. g.,* and other abbreviations are not so good as equivalent English words.

Surely all of us will agree that if all legal documents, insurance policies, and the like could be reworded so that average readers could understand them, we would effect a genuine public service.

Loaded Words

These words are full of dynamite and must be managed with care, if they are ever used at all. The trouble with them is that they do *more* than their job, more than they should; even when their work is not harmful, they can commit a writer or speaker far beyond his desire. They boomerang.

So we need to watch these loaded words because they can "make or break" a sale, deal, collection, or friendship. Charged with implications, they bob up most frequently in communication meant for persuasion and make their employer sound like a propagandist, a hothead, or a radical.

appeaser	obstructionist
capitalist	pessimist
demagogue	predatory rich
dictator	filthy lucre
communist	you must
misinformed	you claim
obligated	your carelessness
nonsense	you misrepresented

Idiomatic Words

Idioms are word groups peculiar to a language but not explained by grammar. Certain words, without rhyme or reason, work only with certain others to communicate a certain message. Established by long usage, they are reputable expressions. For example, we are "determined *to* go" but "bent *on* going."

Using the wrong preposition after certain nouns, verbs, or adjectives is the commonest misuse in managing these word groups. Thus we agree *with* a person, agree *to* a proposal, agree *on* a plan, agree *between* ourselves (two), agree *among* ourselves (more than two), agree *in* part, agree *on* selling, and agree *to* sell.

Again, the word order makes a difference in meaning. Contrast "to see *through* a thing" with "to see a thing *through*." And a man may be an adviser *of, in, for* or *at*—depending upon what words follow.

Those who study any foreign language know what trouble these word groups cause the writer. The only way to use idioms correctly is to learn them one by one, and often our first impulse in using them is instinctively the safest to follow.

Although the number is endless, here are a few idioms that seem to cause a lot of trouble.

abhorrence **of**	could **have** managed
acquiesce **in**	differ **with**
aim **to prove**	different **from**
capable **of** doing	envious **of**
compared **with**	identical **with**
comply **with**	inferior **to**
conform **to, with**	inveigh **against**
correspond **to** that	oblivious **of**

Troublesome Words

By now you may consider all words troublesome, but some are more refractory than others. Every word-manager knows that some look and sound alike but have different meanings. To hold the wrong one off and use the right one, he needs to learn the character of each exactly as he does with human beings.

Some of the most confusing ones are simple words: *lie* and *lay, sit* and *set, affect* and *effect, infer* and *imply, liable* and *likely, like* and *as, practical* and *practicable, principle* and *principal, mediate* and *arbitrate.* Daily use of a handy dictionary like *Webster's New Collegiate* will help anyone in the careful management of these words. It's painstaking work that pays off.

Conclusion

Since we **always communicate to somebody for a purpose,** our first duty is to manage our word-workers to get the best results. Effective and efficient communication depends upon our skill in word-management. If we don't get our communication jobs done smoothly and economically, it's our fault as word-managers. The words are here, and each has a service that awaits our command.

Amazingly enough, words resemble human employees in many ways. Some are more active than others by nature. Some words are ambitious, enterprising, timid, retiring, or downright lazy. Others are overbearing, explosive, tired, inexact, or bothersome. Only by learning their background, personality, traits, and capabilities can we become expert at putting words to work.

Perfect communication we may never achieve, but we can certainly improve what now passes for it in the business world. We can produce better letters, reports, memos, brochures, pamphlets, and bulletins through a better management of words. Getting the best brand and greatest amount of work from each word is a richly rewarding experience. From learning how to manage words, we learn better how to master our own jobs—and eventually, let us hope, ourselves and our own lives. ★ ★ ★

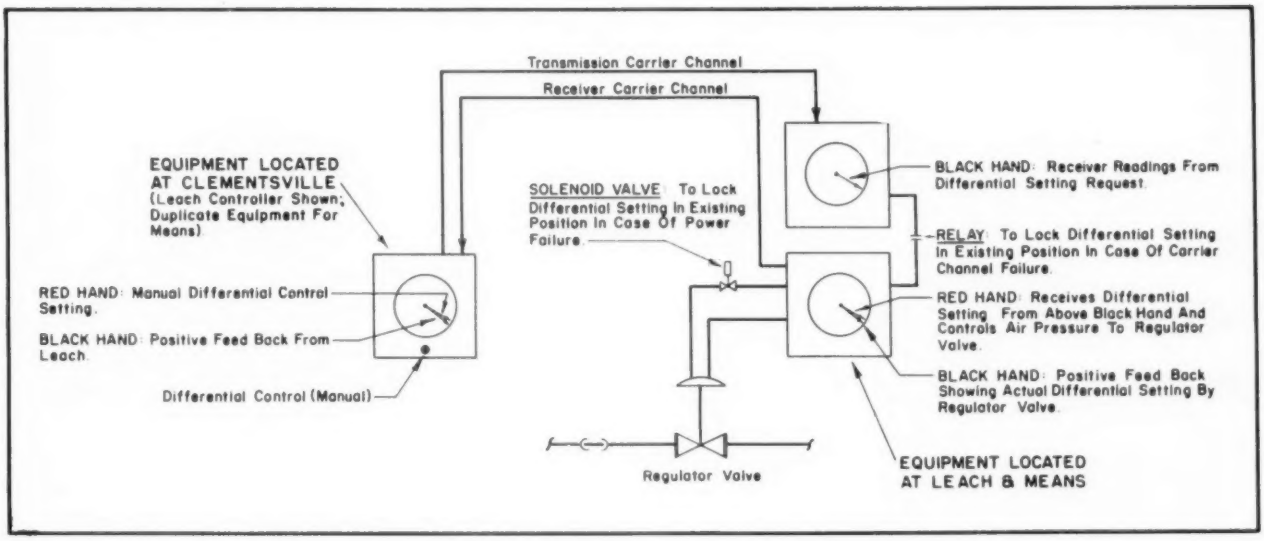

Transmission Carrier Channel
Receiver Carrier Channel
EQUIPMENT LOCATED AT CLEMENTSVILLE (Leach Controller Shown; Duplicate Equipment For Means)
SOLENOID VALVE: To Lock Differential Setting In Existing Position In Case Of Power Failure.
BLACK HAND: Receiver Readings From Differential Setting Request.
RELAY: To Lock Differential Setting In Existing Position In Case Of Carrier Channel Failure.
RED HAND: Manual Differential Control Setting.
BLACK HAND: Positive Feed Back From Leach.
RED HAND: Receives Differential Setting From Above Black Hand And Controls Air Pressure To Regulator Valve.
BLACK HAND: Positive Feed Back Showing Actual Differential Setting By Regulator Valve.
Differential Control (Manual)
Regulator Valve
EQUIPMENT LOCATED AT LEACH & MEANS

Diagram shows circuitry for the remote flow controllers.

Remote Control of Gas Flow At Delivery Measuring Stations

Gene Foulke
Chief Dispatcher
Gulf Interstate Gas Company

Gulf Interstate controlling valves on meter runs at delivery points through unique new remote control system

FEATURE
American Gas Journal

THE trend towards automation in the gas industry took another step forward with the recent installation of remotely-operated flow controllers by Gulf Interstate Gas Company at its Clementsville, Kentucky, compressor station, and its Leach and Means, Kentucky, measuring stations.

Gulf Interstate's use of this equipment, manufactured by Leeds and Northrup, is the first application of the operating principle to the gas industry, according to Leeds and Northrup representatives.

The flow controller system, more accurately described as an *impulse-type telemetering for remote control gas flow,* is designed to permit automatic operation, from Clementsville, of diaphragm type valves on the primary meter runs at the Leach and Means Measuring Stations, thereby controlling the flow of gas through these delivery points.

The accompanying diagram shows the circuitry of the system. Flow settings, established manually on the control instruments at Clementsville, are transmitted by a self-contained impulse duration transmitter over a duplex carrier system. The time cycle corresponding to a closed valve, or zero inch of differential is approximately 0.1 of a sec, while the maximum differential, or 100 in., is approximately 2.1 sec, with proportionate relation to intermediate points.

The carrier channel itself is furnished and maintained by a common-carrier telephone company.

At Clementsville, dual controllers, one for Leach and one for Means, have been installed. The instruments are identical in appearance and operation, and each is independent of the other. The face of each control instrument is

Ralph Williams, measurement engineer, calibrates Gulf Interstate's new flow control equipment at Leach, Kentucky.

The Author

Gene E. Foulke, chief dispatcher for Gulf Interstate Gas Company, Houston, Texas, was born in Des Moines, Iowa. He graduated from University of Iowa with degree of BS in chemical engineering. His previous experience includes pipe line design engineer, for Trunkline Gas Company from 1950 to 1953.

Prior to commencing of operations, Foulke participated in the design and operation of the air cleaning and testing of Gulf Interstate's main line. In addition to his duties as chief dispatcher, Foulke is also responsible for the communications system, which includes VHF, telemetering, and telephonic systems.

calibrated in inches of differential and the "request," is obtained manually by setting the red hand on the desired inches of differential for the measuring station where flow is to be controlled.

The impulse transmitting mechanism develops an impulse, the length of which is directly proportionate to the differential setting. This mechanism consists of two discs rotated at a constant rpm. Each disc has a notch on its circumference, which operates a contact once each revolution. The contact operated by one of these discs is located in a fixed position, and it is this contact that starts each impulse. The contact operated by the second disc moves with the desired differential setting and it is this contact which stops each impulse.

Thus, the length of impulse is varied with the differential setting and keys the channel equipment. The black hands on the two control instruments are monitors and indicate to Clementsville whether the requested setting has been obtained at the delivery point.

At the delivery point, a recording instrument receives the signal from the carrier and indicates, on the face of the instrument, the differential setting received from Clementsville. This receiver operates on the principle of a null balance potentiometer, where the charge on the capacitor is compared with a known millivoltage across a balancing slide wire. The capacitor is charged through a circuit of suitable time constant for the length of time proportional to the received carrier impulse, which is proportional to the transmitted differential. The receipt of this differential is indicated by the black hand on the recording instrument.

The pulse duration signal then passes through a carrier failure protective relay into a balance detector, which positions the red hand setting. This setting then actuates the pneumatic system of the pilot assembly, booster, and bleed valves, producing an output pressure that governs the position of the pneumatically operated diaphragm valve on the primary run at the measuring station.

When the desired differential has been obtained, a monitoring system permits a positive feed-back of the actual measured differential, with visual checks at both the delivery and control points. As the change in differential occurs, the gas measurement is converted to a pulse duration signal and is relayed to Clementsville where it appears on the black hand as a check on the original request.

Future equipment to be used in conjunction with the flow controllers will enable Clementsville to completely shut down or place in service a single 10-in. meter run at either Means or Leach, depending upon delivery requirements.

In addition to the advantage of constant "push-button" control over gas flow at the terminals, the flow controllers represent a field of potential development to the industry as a whole. Through experiment and application of such instruments to the transmission of natural gas comes higher operating efficiency at a reduced cost to the consumer.

Installation and calibration of the flow controllers was accomplished by Gulf Interstate personnel under the supervision of Ralph Williams, measurement engineer at Leach, Kentucky.

★ ★ ★

Quick Couplings:

Rapid connect-disconnect couplings make air and fluid power system easier to use; many applications possible in gas industry

John Lambert

THE GAS INDUSTRY IS WITNESSING A transformation in the application of hydraulic and pneumatic power systems. No longer is this flexible power restricted to a few industrial purposes. More kinds of plants than ever before thought possible are now able to employ air-fluid power. Among these are plants of the Pennsylvania Gas Company, Hope Natural Gas Company, and others.

While these sources of power have long been known, certain engineering difficulties in control and distribution of the energy have been the chief limiting factors for diversified application. Today, modern technical and production research, and new mechanical developments have presented an entirely revised power picture in this field.

There are certain advantages of fluid and air power systems over electrical power systems for different installations. They may be summarized as follows:

1 They are lighter,

2. Less complex in construction and simpler in operation,

3. Maintenance is easier,

4. Power can be supplied more smoothly,

5. There is no loss of power under increased load.

Even with these points however, the designers, manufacturers, and users of such systems have always been confronted with two elementary, but perplexing problems in connection with adapting them in any operation.

These simple factors are:

a. How to tap the power once it has been created, and

b. How to use it most efficiently.

It is easy enough to create a system with pressure built up by a pump or compressor. But, unlike an electric power system, it is necessary to contain the fluid or air, **under pressure,** right up to the moment and point of use. This means that the whole system must be completely closed, with no open ends.

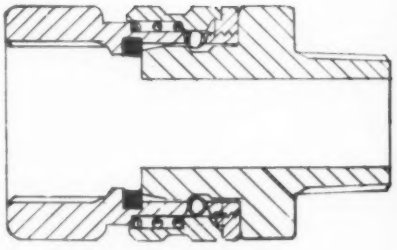


Fig. 1.

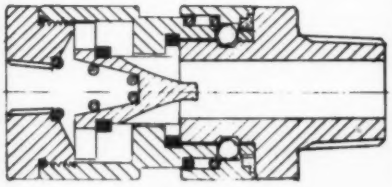


Fig. 2.

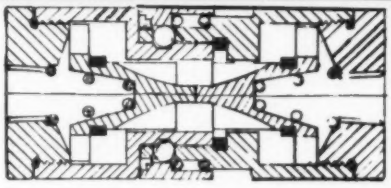


Fig. 3.

In the old methods of tapping into this closed power system, a manual shut-off valve, globe, or gate was placed on the end of a line. Then, to tap the fluid or air power, it was necessary to connect onto the open end. This was usually done by pipe threads. A manual valve was then opened to release the power.

Most of these installations were cumbersome affairs in design and construction. They were not very adaptable to diversified operations to meet factory and processing procedures.

Tapping the power source was always a bothersome job, but most important, in many plants, it called for the services of a pipe-fitter to do the installation each time a connection was needed for power distribution to different locations.

What was needed, as generally agreed by the industry, was the development of some means of plugging into, and unplugging from, fluid and air power systems as easily and simply as is done with a plug and socket in our electrical systems.

The answer to the problem finally came in the form of modern quick connect-disconnect couplings. Like electrical outlets, these couplings permitted tapping of the power source at any desired point on the line. This development has made possible widespread use of air and fluid power systems in dozens of plants.

The construction features of an early design coupling are shown in Fig. 1.

Disconnection is made by sliding the spring loaded sleeve backwards on the coupling. This removes the inner raised ridge on the inside of the sleeve back from the ball bearings, allowing them to back out of the tapered holes and out of the undercut section on the nipple. Without the balls in the undercut, the nipple can be easily removed by just pulling out.

To make a **connection** above procedure is exactly reversed. The sleeve on the coupler half is pulled back and the coupler is pushed onto the nipple

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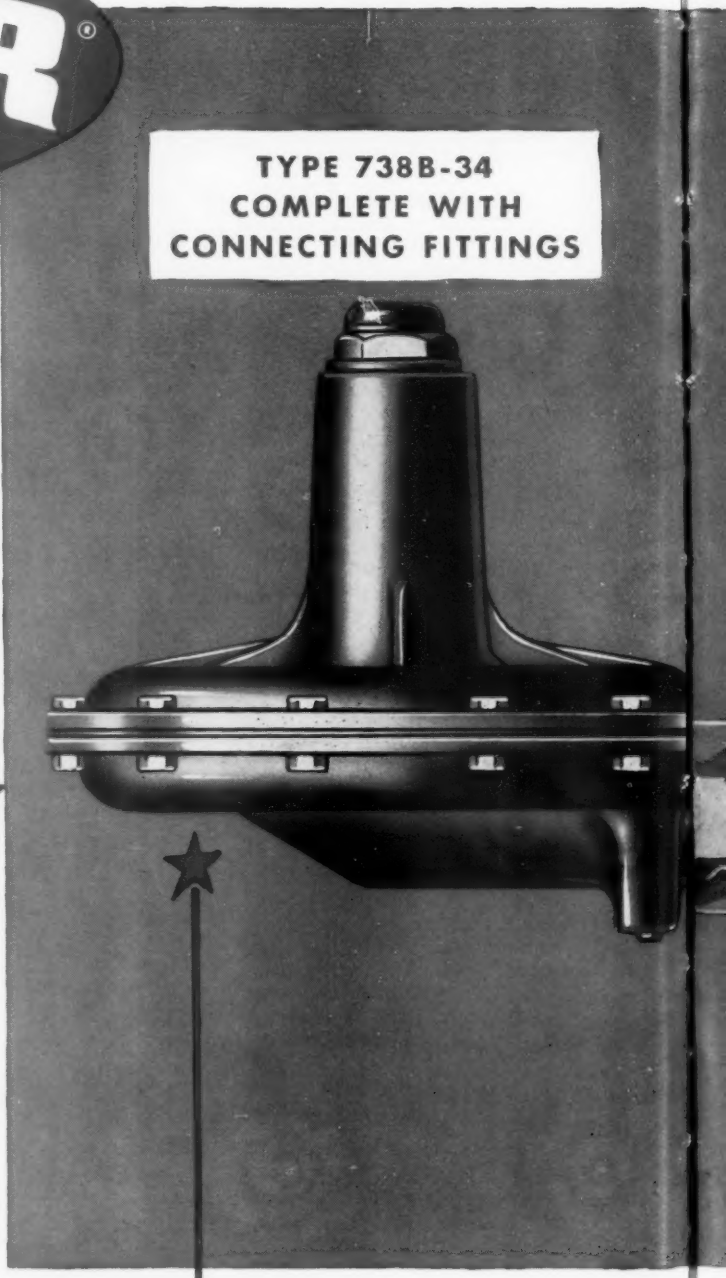

If inlet pressure is temporarily interrupted, regulator shuts off 100% and must be manually reset to resume operation.

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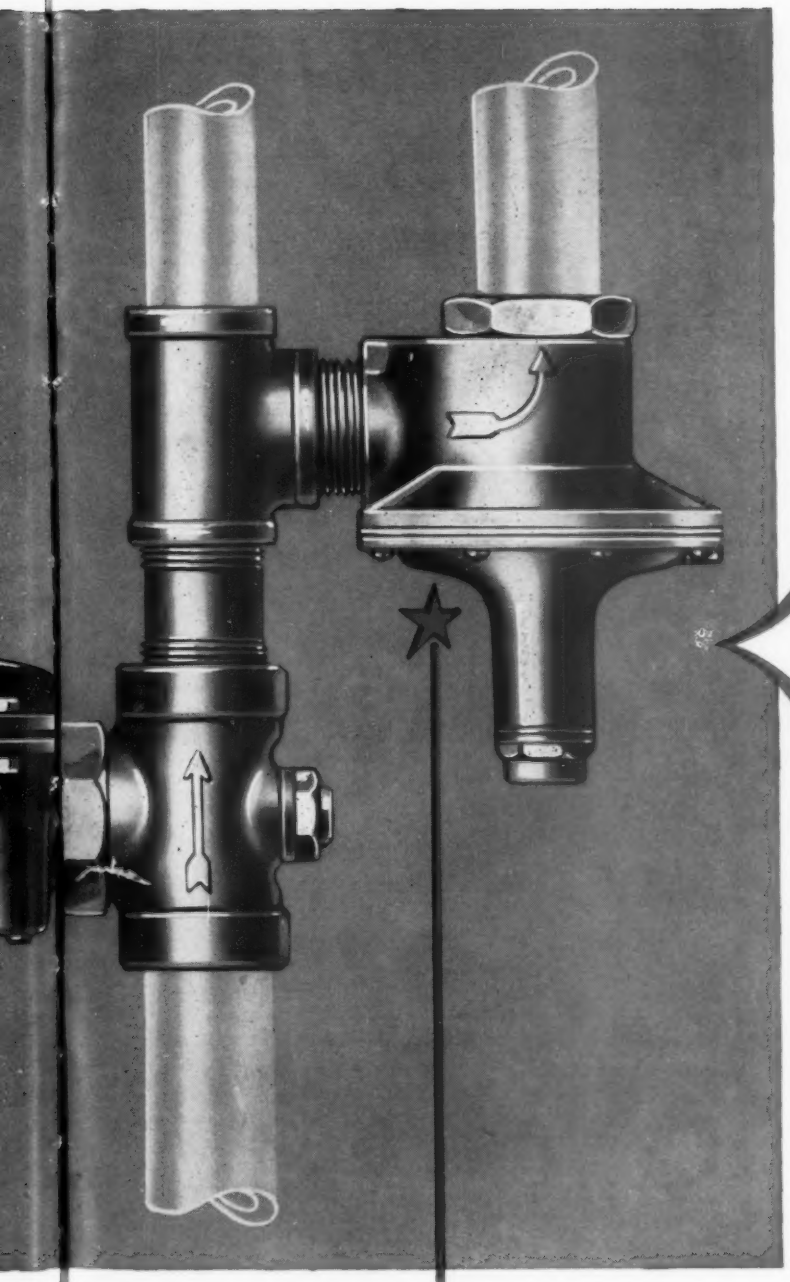

Even if regulator is caused to fail wide open, full capacity relief valve prevents dangerous down stream pressure.

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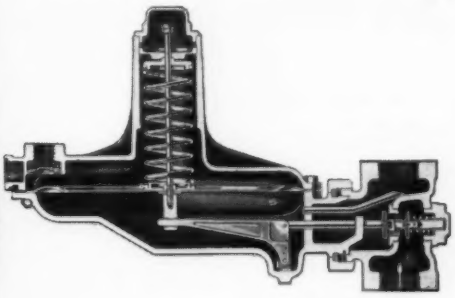

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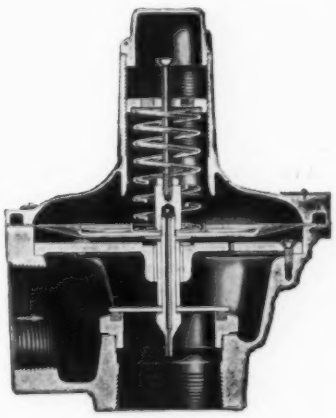

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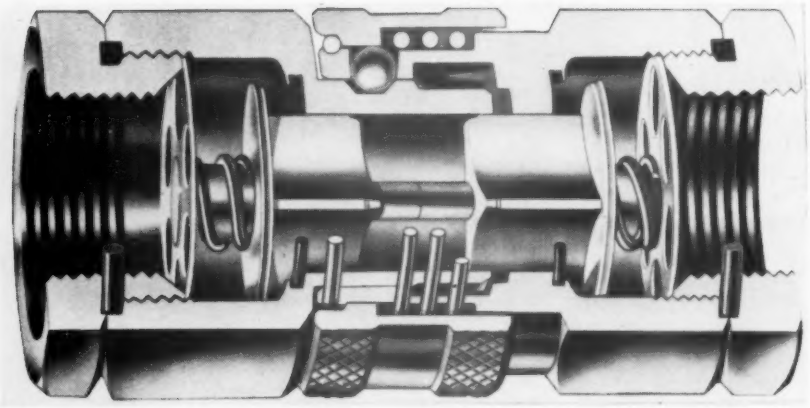
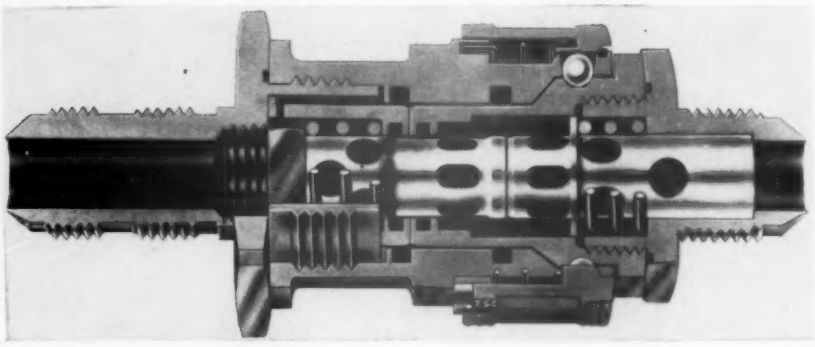


FIG. 4. Coupling, ¼-in. size for hydraulic or pneumatic systems.

FIG. 5. Metal-to-metal valve stop for ¼-in. coupling.

FIG. 6. "No-spill" type coupling is ideal for handling dangerous, toxic products.



and the sleeve released. The sleeve then snaps forward, forcing the balls into the recess on the nipple and locking the two pieces together. Connecting and disconnecting is done in less than 3 seconds.

Fig. 2 illustrates the construction of a coupling (coupler and nipple) with an automatic shut-off valve built into the coupler half. In this design, immediately upon disconnection, the valve in the coupler automatically shuts itself off, permitting no escape of the compressed air or fluid from the coupler end.

A coupling design for preventing escape of fluid from both ends of the coupling, Fig. 3, has automatic shut-off valves incorporated in both the coupler and nipple. Both ends of this coupling shut off instantly and automatically upon disconnection.

Most of the main problems are fairly well answered by these types of couplings. Earlier models were bulky and heavy and caused a great deal of pressure drop. What are the operating values inherent to a low pressure drop?

Pressure drop is inversely a measurement of efficiency — the higher the pressure drop across a given coupling, valve or angle, the lower the resulting efficiency. If you can save ten pounds pressure drop in a system by better component design, you can add 15 per cent to the work output or efficiency of the system.

The pressure drop problem specifically related to ACD couplings has its answer in the design of newer couplings using aerodynamic and hydrodynamic flow principles to achieve higher flow with less pressure drop. Fig. 4 details a successful design employing fluted valves, recessed valve washers and large internal orifices.

It is also possible to use smaller OD's and larger ID's and still have a coupling strong enough to work in the higher pressure systems being used today. This is accomplished by using newly developed steels of much higher tensile strength and surface hardness. In Fig. 4, the design of ¼-in. size is capable of working in hydraulic or pneumatic systems of 10,000 psi working pressure.

A very important design feature of this coupling is the metal-to-metal valve stop of each valve, in the disconnected position. The enlargement in Fig. 5 reveals how the flat underside portion of the valve itself comes to rest on a ledge in the body. This metal-to-metal stop controls the compression of the sealing member, preventing any over-compression or shear of the valve washer. It will also be seen how the valve seals on the periphery of the valve flange. In addition, the metal-to-metal stop permits disconnection at much higher pressures than can be done with some previous designs.

Another feature that contributes to longer life is the design of the seal between the coupler and nipple portions.

Through the use of the "U packer", shown in Fig. 4, with the nipple inserted, the higher the pressure goes, the tighter the seal becomes. This is possible because, as the pressure in the line increases, the inner and outer lips are forced even tighter against the nipple and packer groove respectively. In addition, the nipple slides inside the sealing packer, making impossible any compression of the sealing member. The result is that there can be no compression set and the leakage which could thereby result.

A case in point is the design of a coupling developed specifically for aircraft and guided missile hydraulic and fuel systems, as shown in Fig 6. No spill whatsoever was found on connection of this coupling and but a minimum of air inclusion on disconnection (.2cc on the ½ in size). In addition these couplings were designed to withstand a burst pressure of 12,000 psi in the ¾ in. size. The elimination of spillage and air inclusion was accomplished by the use of flush valves in both the coupler and the nipple. A very significant development of this "No Spill" coupling is the way it has opened many new fields for the use of the quick connect-disconnect coupling technique in the handling of toxic and dangerous fluids, gases and acids.

One feature of these coupling designs is that, on disconnection, there is a slight spillage of the fluid trapped between the two valves. In most applications this spill is of no consequence. However, in some hydraulic systems both leakage on disconnection and air inclusion on connection is of vital importance.

The couplings described are made from a variety of stainless steels and equipped with inert sealing materials to handle "almost anything that flows."

Pipe Sizing Methods

For plant and field gas lines

M. L. Arnold
Chief Gas Engineer,
Richfield Oil Corporation,
Los Angeles, California

FEATURE
American Gas Journal

PROBABLY THE SIMPLEST PROBLEM WITH WHICH THE DESIGNER of gas piping systems is confronted is that in which gas of a specified rate is to be transported between two points a known distance apart with a designated initial and terminal pressure. For the solution of this type of problem, we use the following modification of Weymouth's flow equation:

$$Q = (A_1)\ (P_1)\ (C)\ (F_T \times F_G \times F_{PV} \times E) \quad . \quad . \quad . \quad . \quad . \quad 1$$

$$Q = (A_2)\ (P_2)\ (C)\ (F_T \times F_G \times F_{PV} \times E) \quad . \quad . \quad . \quad . \quad . \quad 2$$

In this equation Q is the rate of flow in standard M cubic feet per day and P_1 and P_2 are the initial and terminal pressures respectively in pounds per square inch absolute. C is called the pipe line coefficient and is equal to $\frac{48.759\ d^{2.5}}{\sqrt{L}}$ where d is the internal diameter of the pipe in inches and L is the length of the line in feet. The numerical constant has been modified to permit orific meter correction factors for temperature and gravity, F_T and F_G, to be used. F_{PV} is the usual orifice meter correction for super-expansibility and E is a pipe line efficiency factor determined by experience.

A comparison of 1 and 2 with the usual form of Weymouth's equation:

$$Q = (F_T \times F_G)\ C \sqrt{P_1^2 - P_2^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

indicates that

$$A_1P_1 = A_2P_2 = \sqrt{P_1^2 - P_2^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

By suitable algebraic manipulation, it can be shown that:

$$A_1 = \sqrt{\frac{2\ \Delta P}{P_1} - \left(\frac{\Delta P}{P_1}\right)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

and,

$$A_2 = \sqrt{\frac{2\ \Delta P}{P_2} + \left(\frac{\Delta P}{P_2}\right)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

We have found it convenient to plot values of C vs L, and of A_1 and A_2 vs $\frac{\Delta P}{P_1}$ and $\frac{\Delta P}{P_2}$ respectively. Replicas of these charts are shown in Fig. 1, 2 and 3.

Fig. 1 has been prepared for standard weight pipe. Lines for pipe of other diameters may easily be added as follows: *Multiply the internal diameter of the pipe by 10, locate this value on the Pipe Line Coefficient scale, then move horizontally to the right until an intersection is made with the diagonal line extending upward to the right of the chart. A line drawn through this point parallel to the other coefficient lines, will give coefficients for the new pipe size.*

For the type of problem under consideration, either formula 1 or 2 may be used. Assuming that formula 1 is selected, the procedure is to find ΔP by subtracting P_2 from P_1. The ratio $\frac{\Delta P}{P_1}$ is then determined. From this ratio A_1 is found by reference to Fig. 2. Knowing F_G, F_T, F_{PV}, and E, C is found as follows:

$$C = \frac{Q}{(A_1)(P_1)(F_G \times F_T \times F_{PV} \times E)} \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

Knowing the length of the line in feet, the required diameter of the pipe line may be determined by reference to Fig. 1.

In practice, the required diameter usually falls between two of the commercially available sizes. If the pressure drop which will be experienced with the smaller size cannot be tolerated, then the larger size must be used. As an alternate, the line may be composed of sections of both sizes of pipe, the length of each section being such that the required overall coefficient is obtained. For this type of computation, it is convenient to use Fig. 1 as a chart of equivalent pipe lengths.

Assume that in the problem referred to above, the length of the line is 1500 ft and the required coefficient is 35. Reference to Fig. 1 shows that a pipe of 3.5-in. inside diameter is required. If no 3.5-in. inside diameter pipe is available, a pipe line having a coefficient of 35 can be constructed by using appropriate lengths of 4-in. standard line pipe and 3-in. standard line pipe. Referring again to Fig. 1, it will be noted that 1500 ft of 3.5-in. pipe has the same coefficent as 3300 ft of 4-in. standard pipe.

As a trial, assume that the line will be constructed of 900 ft of 4-in. and 600 ft of 3-in. pipe. Reference to Fig. 1 shows that 600 ft of 3-in. pipe line has a coefficient of 40. This is also the coefficient of 2500 ft of 4-in. pipe line; so, the equivalent length of the pipe line, in terms of 4-in. pipe, is 900 plus 2500, or 3400 ft. This is 100 ft too much. By a process of trial and error, it is found that a pipe line constructed of 550 ft of 3-in. standard pipe and 950 ft of 4-in. standard pipe has an equivalent length of 3300 ft of 4-in. pipe line, and, hence, has the required coefficient of 35.

Quite frequently a gathering system consists of a trunk line with gas added to it at several points. This is illustrated in Fig. 4. In this case, it is convenient to assume that the pressure drop will be constant per foot of length.

Since the distance from the plant to the point at which Q_2 is added is half the total length of the line, it will be assumed that the pressure drop in this section will be one half ($P_1 - P_2$). The pipe line diameter is found as before. Since we are starting at the plant end, formula 2 is used. The flow in this

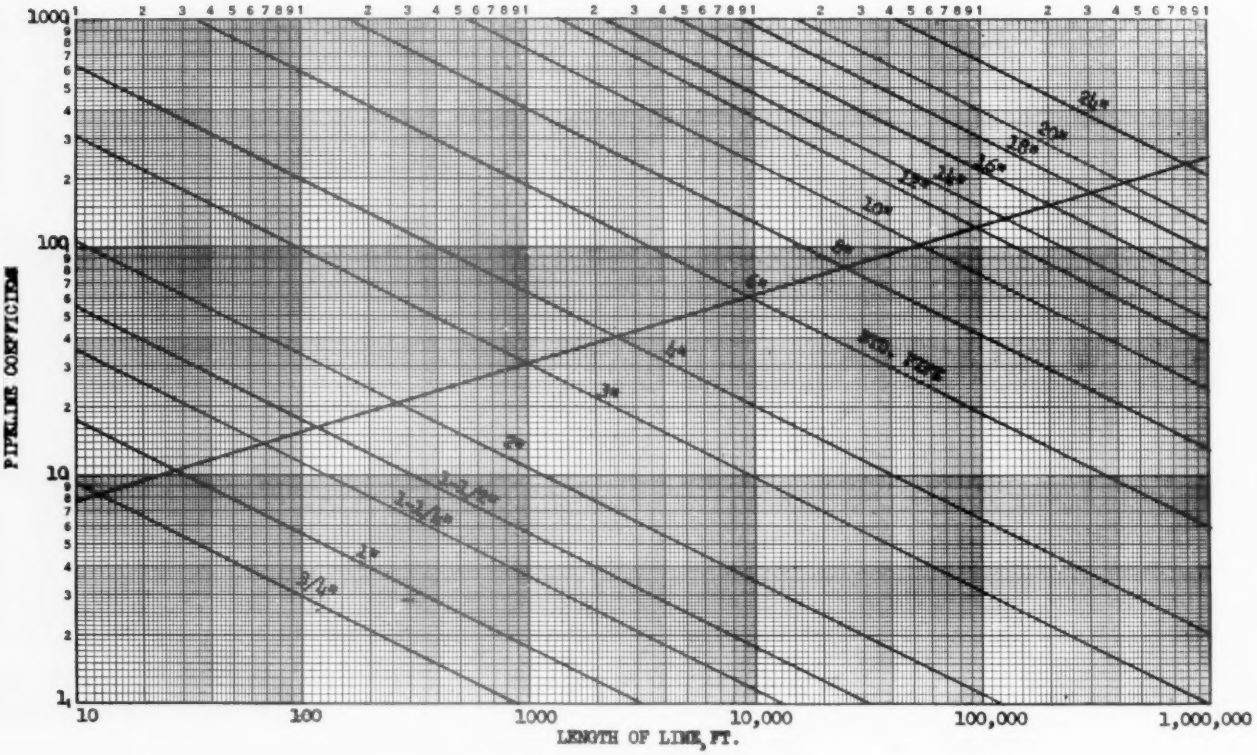


FIG. 1. Pipe line coefficient chart.

section is of course Q_1 plus Q_2 plus Q_3. If the diameter indicated is not commercially available and a larger or smaller size of pipe is selected, the pressure drop for the section is computed.

In either case, P_2 plus the pressure drop in the section becomes the new value of P_2 to use in sizing the next section of pipe line, and so on. If the branch lines are long and gas is picked up at more than one point, they are treated in a similar manner. If two sections of the pipe line operate in parallel, their coefficients are additive. For example, the coefficient for 1000 ft of 4-in. standard pipe is 64 and the coefficient for 1000 ft of 3-in. standard pipe is 31. The coefficient for the two lines operated in parallel is 95.

For the pipe line efficiency factor, E, a number less than unity is used, ordinarily in the range of 0.8 to 0.95. Pipe lines transporting wet gas over rough terrain show lower efficiencies than lines transporting dehydrated residue dry gas. The efficiencies of wet gas lines can be improved considerably by providing an adequate number of drips along the line.

At high pressures, deviation from the gas laws must be taken into consideration. For short lines such as we are considering here, it is usually satisfactory to use a correction factor corresponding to the estimated average pressure in the section of pipe line under consideration. For long lines or high pressure drops, the methods of Clindenquist(1), Joffee(2), or others should be used.

For certain applications, other modifications of Weymouth's equation are useful. For example, we may write

$$\sqrt{P_1^2 - P_2^2} = \sqrt{(P_1 - P_2)(P_1 + P_2)} = \sqrt{\Delta P(P_1 + P_2)} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

If we define the average pressure in the pipe line, P_{AV}, as $\frac{P_1 + P_2}{2}$ then $P_1 + P_2 = 2P_{AV}$.

Substituting this in equation 8 enables us to write Weymouth's formula as

$$Q = \sqrt{2(\Delta P)(P_{AV})}\,(C)(K) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

$$Q = \sqrt{\frac{2\Delta P}{P_{AV}}}\,(P_{AV})(C)(K) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Where

$$K = (F_T)(F_G)(F_{PV})(E) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

For those problems in which the value of the second term under the radical in equations 5 and 6 is small as compared to the first term, the second term may be dropped and the following equations formed

$$Q = \sqrt{2\Delta P(P_1)}\;(C)\;(K) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

$$Q = \sqrt{2\Delta P(P_2)}\;(C)(K) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

The error in equations 12 and 13 is a function of the magnitude of the ratios $\frac{\Delta P}{P_1}$ and $\frac{\Delta P}{P_2}$. For a value of 0.2 for the ratios, equation 12 will give results which are about 5.5 per cent high while equation 14 will give results which are about 5.2 per cent low.

Should it be desired to determine the ratio $\frac{\Delta P}{P_1}$ without reference to Fig. 2, the following relationship may be formed by substituting formula 5 in formula 1, squaring both sides, and rearranging:

$$2\frac{\Delta P}{P_1} - \left(\frac{\Delta P}{P_1}\right)^2 = \frac{Q^2}{(P_1 CK)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

Reducing to the standard quadratic form and solving for $\frac{\Delta P}{P_1}$ yields

$$\frac{\Delta P}{P_1} = 1 - \sqrt{1 - \frac{Q^2}{(P_1 CK)^2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (15)$$

For small values of $\frac{Q^2}{(P_1 CK)^2}$ this may be written

$$\frac{\Delta P}{P_1} = 1 - \left(1 - \frac{Q^2}{2(P_1 CK)^2}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (16)$$

or,

$$\frac{\Delta P}{P_1} = \frac{Q^2}{2(P_1 CK)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (17)$$

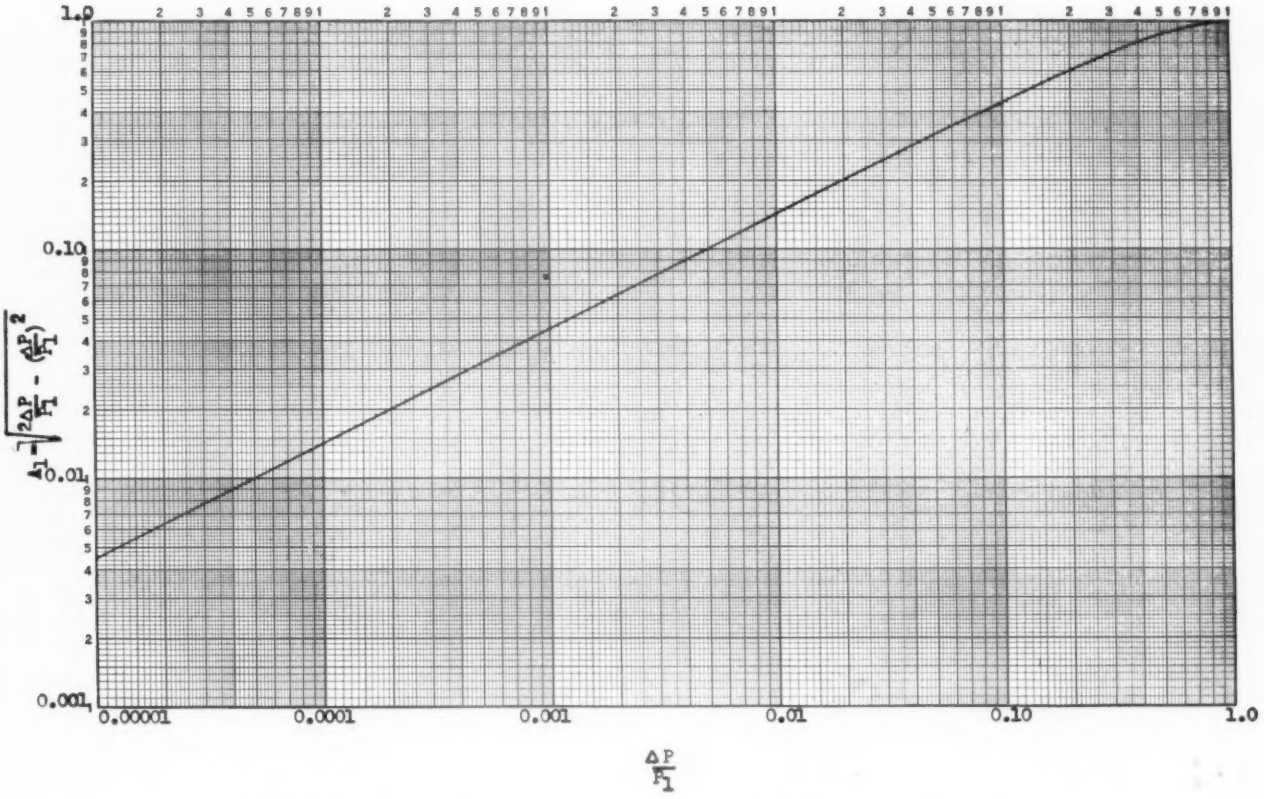


FIG. 2. Values of A_1 for use in the equation: $Q = A_1 P_1 C(F_T \times F_G \times F_{PV} \times E)$.

In a similar manner, it can be shown that

$$\frac{\Delta P}{P_2} = \sqrt{1 + \frac{Q^2}{(P_2CK)^2}} - 1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (18)$$

And for small values of $\frac{Q^2}{(P_2CK)^2}$

$$\frac{\Delta P}{P_2} = \frac{Q^2}{2(P_2CK)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (19)$$

For cases where the gas must be compressed and some flexibility is permitted in fixing the pressure at the compressor end of the line, the economics of the problem should be considered. If several sizes of pipe are involved in the system, such a study may actually save time over the approach previously considered for it provides the designer with charts similar to those shown in Fig. 6 and 7, from which the proper size of pipe for the various sections may be read directly.

The usual and simplest approach to the problem is to consider the energy loss in the pipe line in relation to the cost of compression and the cost of installing various size pipe lines. For the purpose of this discussion, energy loss will be defined as the work of compression required to restore the gas flowing in a pipe line at a pressure P_2 to a pressure P_1 at which it existed at some point upstream. This case is illustrated in Fig. 5a. To determine the energy loss in the pipe line, we first write

$$\Delta P = P_1 - P_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (20)$$

This is then divided by P_1 to give

$$\frac{\Delta P}{P_1} = 1 - \frac{P_2}{P_1} = 1 - \frac{1}{\frac{P_1}{P_2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (21)$$

In compressor terminology, the ratio $\frac{P_1}{P_2}$ is known as the compression ratio, R.

Making this substitution in (21) yields

$$\frac{\Delta P}{P_1} = 1 - \frac{1}{R} \quad . \quad . \quad . \quad . \quad . \quad (22)$$

Rearranging and solving for R

$$R = \frac{1}{1 - \frac{\Delta P}{P_1}} = \left(1 - \frac{\Delta P}{P_1}\right)^{-1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (23)$$

Gill[3] gives the following expression for determining the adiabatic horsepower of compression

$$\text{Horsepower (HP)} = 0.0446\, Q \frac{n}{n-1}\left[R^{\frac{n-1}{n}} - 1\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (24)$$

where n is the ratio of specific heats for the gas being compressed and the other terms are as previously defined.

Substituting the value of R from 23 in 24 yields

$$\text{H.P.} = 0.0446\, Q \frac{n}{n-1}\left[\left\{\left(1 - \frac{\Delta P}{P_1}\right)^{-1}\right\}^{\frac{n-1}{n}} - 1\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (25)$$

or,

$$\text{H.P.} = 0.0446\, Q \frac{n}{n-1}\left[\left\{1 - \frac{\Delta P}{P_1}\right\}^{\frac{1-n}{n}} - 1\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (26)$$

Substituting the value of $\frac{\Delta P}{P_1}$ from (15) in (26) yields, on rearranging

$$\text{H.P.} = 0.0446\, Q \frac{n}{n-1}\left[\left\{1 - \frac{Q^2}{(P_1CK)^2}\right\}^{\frac{1-n}{2n}} - 1\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (27)$$

Dividing the right hand side of 27 by the mechanical efficiency (ME) of the compression equipment yields

$$\text{BHP} = \frac{0.0446}{(ME)}\, Q \frac{n}{n-1}\left[\left\{1 - \frac{Q^2}{(P_1CK)^2}\right\}^{\frac{1-n}{2n}} - 1\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (28)$$

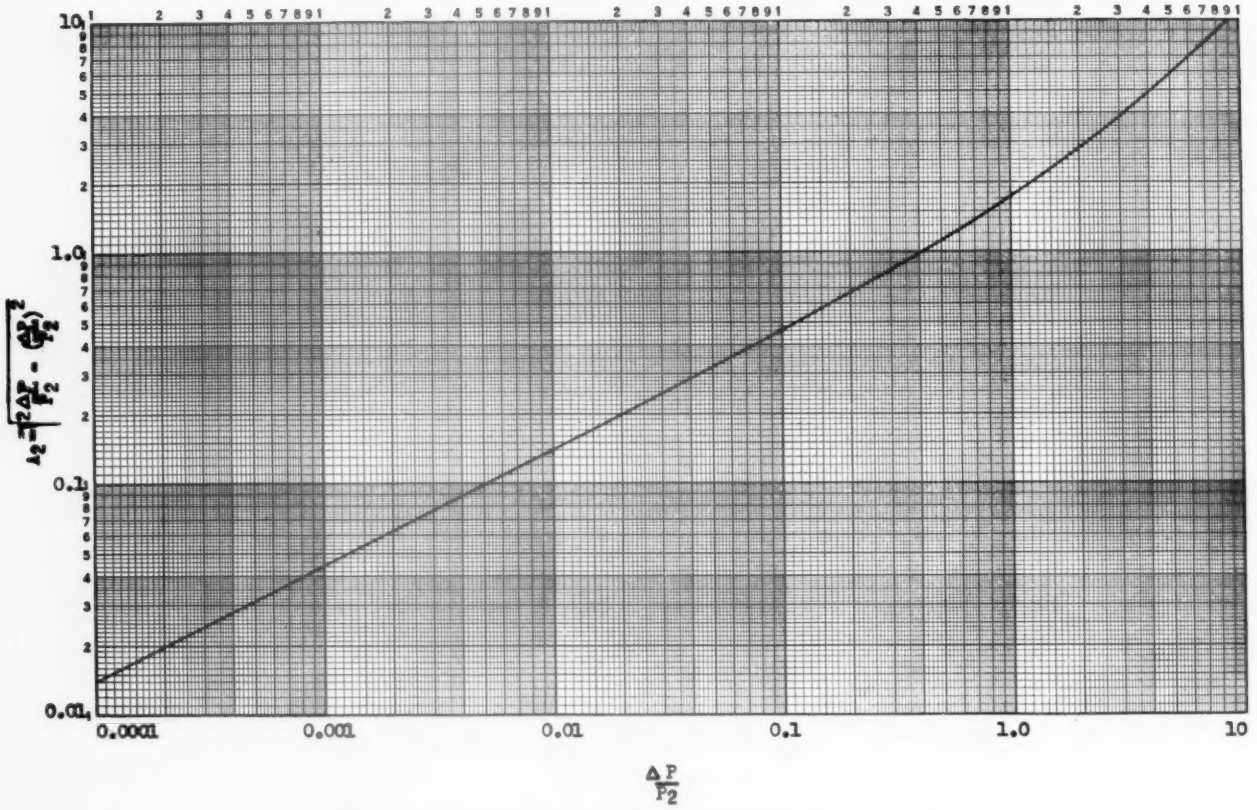


FIG. 3. Values of A_2 for use in the equation: $Q = A_2 P_2 C(F_T \times F_G \times F_{PV} \times E)$.

Equation 28 gives the size of the compressor that must be installed to pump the gas from P_2, the pressure at the terminus of the line, to P_1, the pressure at the inlet of the line. The total cost, then, of delivering the gas to the plant at a pressure P_1 is the cost of the line, the cost of the compressors, plus the cost of operating and maintaining the compressor and pipe line for a specified period of time. These costs should include insurance, taxes, and interest on the investment. An allowance should be made for the salvage value of the equipment and pipe line at the end of the period.

In algebraic notation, this may be expressed as follows:

$$T = I + \frac{0.0446\,BQ}{(ME)} \frac{n}{n-1} \left[\left\{ 1 - \frac{Q^2}{(P_1CK)^2} \right\}^{\frac{1-n}{2n}} - 1 \right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (29)$$

where

T = total net cost of installing and operating the pipe line and compressor,

I = cost of installing and maintaining the pipe line, less salvage value, and

B = cost of installing, operating and maintaining the compressor in dollars per BHP capacity, less salvage value.

The value of C used must correspond to the length and diameter of the line for which the cost is estimated. Plotting T vs Q for a series of lines of different diameters at constant P_2 gives a chart such as that shown in Fig. 6. It shows clearly the range of flow rates for which each size of pipe line is most economical. At the point at which the curve for a given pipe size intersects the curve for the next larger pipe size, the total cost for both size lines is the same.

For small values of $\frac{Q^2}{(P_1CK)^2}$, such as will usually be found in plant and field systems, equation 29 may be written as follows

$$T = I + \frac{0.0223\,B}{(ME)} \frac{Q^3}{(P_1CK)^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (30)$$

For this circumstance the points of intersection for adjacent pipe sizes may be easily determined and step-wise charts such as shown in Fig. 7 constructed at a considerable saving in time. The equation for locating the points of intersection is as follows:

$$Q_{3,4} = \left[\frac{(I_4 - I_3)\,(ME)\,(P_1KC_3C_4)^2}{0.0223\,B\,(C_4^2 - C_3^2)} \right]^{\frac{1}{3}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (31)$$

The subscripts 3 and 4 refer to 3-in. and 4-in. pipe sizes respectively and $Q_{3,4}$ indicating that this is the value of Q at which T for the two line sizes is the same. The values of the subscripts must, of course, correspond to the sizes of the pipe lines equated.

It can be shown that the points of intersection as given by equation 31 are independent of the length of the line. Hence, when preparing charts such as Fig. 6 and 7 for use in selecting the most economical pipe size for various flow rates, it is immaterial what length of line is used for determining the values of C so long as the same length is used for each pipe size and so long as the cost, I, is based upon this same length. It can also be shown that equations 30 and 31 are valid for either P_1 or P_2.

Ridgeway[4] has shown that at high pressures a correction should be made to the horsepower required for compression to take into account the effects of super-compressibility. Where required, this factor can be introduced as a multiplier in the second term of equations 29 and 30 and in the denominator of equation 31.

Except for the interchangeability of P_1 and P_2, the fore-

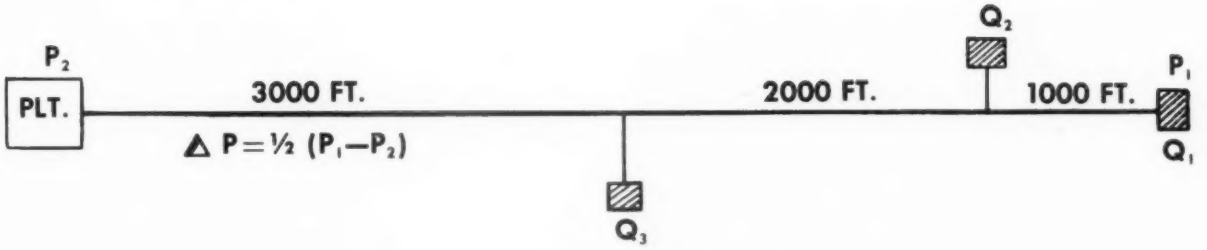


FIG. 4. Typical simple gas gathering system.

going discussion applies also to the corresponding equations developed for subsequent cases.

Actual plant and field operations usually are of the type shown in Fig. 5b and 5c. In Fig. 5b gas is delivered to the compressor at a constant pressure P_3. It is compressed to a pressure P_1, which is a function of the length and diameter of the discharge line, and delivered at the end of the line at a constant pressure P_2. For this type of operation, the total cost of installing and operating the pipe line, plus the cost of installing and operating the additional horsepower required to overcome the pressure drop in the pipe line, may be determined in a manner similar to the foregoing and is as follows:

$$T = I + \frac{0.0446\,BQ}{(ME)} \frac{n}{n-1}\left(\frac{P_2}{P_3}\right)^{\frac{n-1}{n}}\left[\left\{1 + \frac{Q^2}{(P_2CK)^2}\right\}^{\frac{n-1}{2n}} - 1\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (32)$$

For small values of $\frac{Q^2}{(P_2CK)^2}$ this reduces to

$$T = I + \frac{0.0223\,B}{(ME)}\left(\frac{P_2}{P_3}\right)^{\frac{n-1}{n}} \frac{Q^3}{(P_2CK)^2} \quad . \quad . \quad . \quad (33)$$

The points of intersection are

$$Q_{3\text{-}4} = \left[\frac{(ME)(I_4 - I_3)(P_2KC_3C_4)^2}{0.0223\,B\left(\frac{P_2}{P_3}\right)^{\frac{n-1}{n}}(C_4^2 - C_3^2)}\right]^{\frac{1}{3}} \quad . \quad . \quad (34)$$

If two stage compression is employed and interstage losses are neglected, the formulas are as follows

$$T = I + \frac{0.0892\,BQ}{(ME)} \frac{n}{n-1}\left(\frac{P_2}{P_3}\right)^{\frac{n-1}{2n}} \left[\left\{1 + \frac{Q^2}{(P_2CK)^2}\right\}^{\frac{n-1}{4n}} - 1\right] \quad . \quad . \quad (35)$$

For small values of $\frac{Q^2}{(P_2CK)^2}$

$$T = I + \frac{0.0223\,B}{(ME)}\left(\frac{P_2}{P_3}\right)^{\frac{n-1}{2n}} \frac{Q^3}{(P_2CK)^2} \quad . \quad . \quad (36)$$

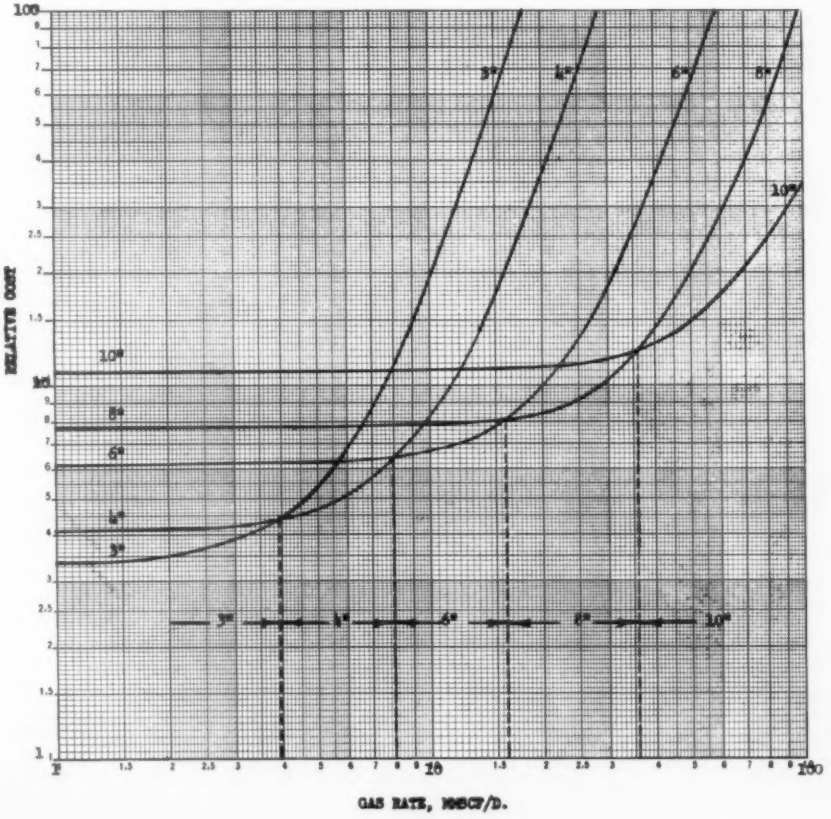


FIG. 6. Typical chart for determining the most economic gas pipe line size (method of Equation 29).

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The points of intersection are

$$Q_{3,4} = \left[\frac{(ME)(I_1 - I_3)(P_2KC_3C_4)^2}{0.0223\,B\left(\frac{P_2}{P_3}\right)^{\frac{n-1}{2n}}(C_4^2 - C_3^2)}\right]^{\frac{1}{3}} \quad . \quad . \quad (37)$$

In Fig. 5c gas is delivered to a pipe line at a constant pressure P_1. After flowing through the pipe line, the gas is compressed from some pressure P_2 to a constant discharge pressure P_3. For this case the following equations can be developed:

$$T = I + \frac{0.0446\,BQ}{(ME)}\,\frac{n}{n-1}\left(\frac{P_3}{P_1}\right)^{\frac{n-1}{n}} \left[\left\{1 - \frac{Q^2}{(P_1CK)^2}\right\}^{\frac{1-n}{2n}} - 1\right] \quad . \quad . \quad . \quad (38)$$

For small values of $\frac{Q^2}{(P_1CK)^2}$ this reduces to

$$T = I + \frac{0.0223\,B}{(ME)}\left(\frac{P_3}{P_1}\right)^{\frac{n-1}{n}}\frac{Q^3}{(P_1CK)^2} \quad . \quad . \quad (39)$$

The points of intersection are

$$Q_{3,4} = \left[\frac{(I_4 - I_3)(ME)(P_1KC_3C_4)^2}{0.0223\,B\left(\frac{P_3}{P_1}\right)^{\frac{n-1}{n}}(C_4^2 - C_3^2)}\right]^{\frac{1}{3}} \quad . \quad . \quad (40)$$

For two stage compression

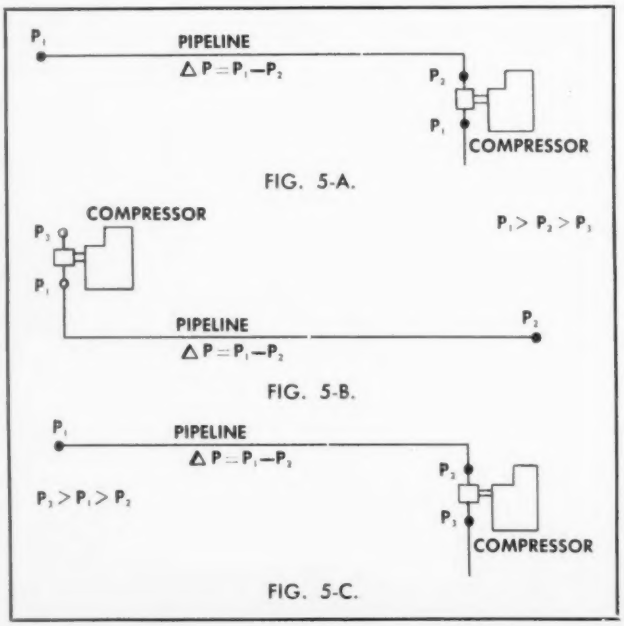
$$T = I + \frac{0.0892\,BQ}{(ME)}\,\frac{n}{n-1}\left(\frac{P_3}{P_1}\right)^{\frac{n-1}{2n}} \left[\left\{1 - \frac{Q^2}{(P_1CK)^2}\right\}^{\frac{1-n}{4n}} - 1\right] \quad . \quad . \quad . \quad (41)$$

and for small values of $\frac{Q^2}{(P_1CK)^2}$

$$T = I + \frac{0.0223\,B}{(ME)}\left(\frac{P_3}{P_1}\right)^{\frac{n-1}{2n}}\frac{Q^3}{(P_1CK)^2} \quad . \quad . \quad (42)$$

and

$$Q_{3,4} = \left[\frac{(I_4 - I_3)(ME)(P_1KC_3C_4)^2}{0.0223\,B\left(\frac{P_3}{P_1}\right)^{\frac{n-1}{2n}}(C_4^2 - C_3^2)}\right]^{\frac{1}{3}} \quad . \quad . \quad (43)$$



Regulator or control valves are frequently a part of the gathering system. Some manufacturers publish valve flow coefficients by means of which the flow capacity of the valves may be determined from formulas similar to the following

$$q = \frac{1364\, C_v \sqrt{(P_1 - P_2)P_1}}{\sqrt{GT_f}} \quad . \quad . \quad . \quad (44)$$

and

$$q = \frac{1390\, C_v \sqrt{(P_1 - P_2)P_2}}{\sqrt{GT_f}} \quad . \quad . \quad . \quad (45)$$

where

q = *flow through the valve in standard cubic feet per hour*
C_v = *valve flow coefficient*
G = *specific gravity, air = 1.0*
T_f = *flowing temperature, deg Rankine*

These equations are reported in an article by Brockett.[5] Rewriting (44):

$$q = \sqrt{\frac{\Delta P}{P_1}}\,(P_1)\,(1364)(C_v)\,\frac{1}{\sqrt{G}} \times \frac{1}{\sqrt{T_f}} \quad . \quad . \quad (46)$$

Changing this to consistent units

$$Q = \sqrt{\frac{\Delta P}{P_1}}(P_1)\,\frac{24\,(1364)}{1000\sqrt{520}}(C_v)(K) \quad . \quad . \quad (47)$$

where E in K = 1.0

On squaring both sides and rearranging it yields

$$\frac{\Delta P}{P_1} = \frac{Q^2}{[(P_1)(1.4363)(C_v)(K)]^2} \quad . \quad . \quad . \quad . \quad . \quad (48)$$

By substituting this value of $\frac{\Delta P}{P_1}$ in (26), equations similar to the pipe line equations can be developed. These are as follows:

$$T' = I' + \frac{0.0446\, BQ}{(ME)}\,\frac{n}{n-1}$$
$$\left[\left\{1 - \frac{Q^2}{(1.4363 P_1 C_v K)^2}\right\}^{\frac{1-n}{n}} - 1\right] \quad . \quad . \quad (49)$$

where

T' = total net cost of installing and operating the regulator and compressors
I' = cost of installing and maintaining the regulator (with block valves and by-pass if used) less salvage value.

For small values of $\frac{Q^2}{(1.4363\, P_1 C_v K)^2}$

$$T' = I' + \frac{0.02162\, B}{(ME)}\,\frac{Q^3}{(P_1 C_v K)^2} \quad . \quad . \quad . \quad (50)$$

and the points of intersection are

$$Q_{3\text{-}4} = \left[\frac{(I'_4 - I'_3)\,(ME)\,[P_1 K (C_v)_3 (C_v)_4]^2}{0.02162\, B\,[(C_v)_4^2 - (C_v)_3^2]}\right]^{\frac{1}{6}} \quad . \quad . \quad (51)$$

The subscripts 3 and 4 refer to 3-in. and 4-in. regulator sizes respectively, and $Q_{3\text{-}4}$ indicates that this is the value of Q at which T′ for the two regulator sizes is the same. The value of the subscripts must, of course, correspond to the sizes of the regulators being compared.

Starting with (45), the same type of equations can be developed. In this case

$$T' = I' + \frac{0.0446\, BQ}{(ME)}\,\frac{n}{n-1}$$
$$\left[\left\{1 + \frac{Q^2}{(1.4637 P_2 C_v K)^2}\right\}^{\frac{n-1}{n}} - 1\right] \quad . \quad . \quad (52)$$

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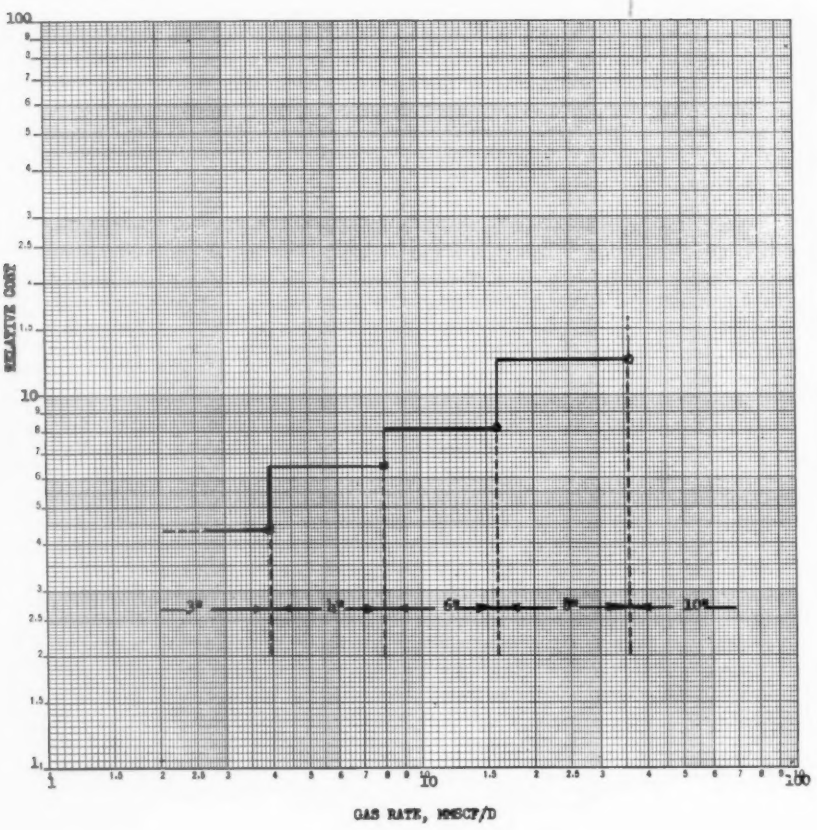

FIG. 7. Typical step wise chart for determining the most economic gas pipe line size (method of Equation 31).

and for the approximate formulas

$$T' = I' + \frac{0.02082\ B}{(ME)} \frac{Q^2}{(P_2 C_v K)^2} \quad . \quad . \quad . \quad (53)$$

and

$$Q_{3,4} = \left[\frac{(I'_4 - I'_3)\ (ME)\ [P_2 K (C_v)_3 (C_v)_4]^2}{0.02082\ B\ [(C_v)_4^2 - (C_v)_3^2]} \right]^{1/2} \quad . \quad (54)$$

The final case to be considered is that in which gas from a high pressure source is to be distributed at a much lower pressure. Here the greatest economy can be effected by using pipe of small enough diameter to completely utilize the available pressure drop. The velocities should not be so high, however, as to cause failure of the pipe line or fittings by erosion.

It is the tentative thinking of the engineering department of one manufacturing company that the severity of erosion may be a function of the kinetic energy of the flowing fluid divided by the area of the surface subject to erosive attack. Since most failures occur at bends, it seems logical that the area of the surface subject to attack be taken as the cross sectional area of the pipe line. Mathematically this may be expressed as follows:

$$KE = \frac{wv^2}{2g} = \frac{w^3}{2g\rho^2} = \frac{\rho v^3}{2g} \quad . \quad . \quad . \quad (55)$$

where

KE = kinetic energy, in ft-lb per sec per sq ft
w = pounds of fluid flowing per second per sq ft
v = linear velocity of flow in ft per sec
ρ = density of the flowing fluid in pounds per cu ft
g = acceleration due to gravity

For the case of liquids or solids entrained in gas or vapor streams, the department believes that it may be possible to assume that the kinetic energy of the gas or vapor has no erosive effect and that only the entrained droplets or particles will cause damage. If it is further assumed that this damage will be proportional to the weight fraction of the entrained material in the stream, equation 46 may be modified as follows:

$$KE = \frac{f_w w^3}{2g\rho^2} = \frac{f_w \rho v^3}{2g} \quad . \quad . \quad . \quad . \quad (56)$$

in which f_w is the weight fraction of the entrained material.

It is the opinion of this company's engineers that the equation should also include terms relating to the erosive properties of the entrained particles and to the sharpness of the bends encountered, but the nature of these factors has not been determined as yet. They have some indication that, for the case of a gas carrying entrained liquid droplets, the maximum permissible value of kinetic energy as determined by equation 55 is in the neighborhood of 1500 to 2000 ft-lb per sec per sq ft. For entrained solids, the permissible value is probably much lower, perhaps in the neighborhood of 600, for a gas stream carrying catalyst fines in straight pipe without bends.

The author wishes to thank the Griscom-Russell Company for permission to publish equations 55 and 56 and the discussion relating to them. He also wishes to give credit to a former associate, George H. Horne, for the development of equations 3 and 4, and to E. P. Valby and J. Johann, of Richfield for their assistance in developing other portions of the discussion.

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FPC REPORT

IRON RANGES NATURAL GAS COMPANY'S application to build new facilities in Minnesota has been consolidated with previously scheduled hearings of Midwestern Gas Transmission Company and Tennessee Gas Transmission Company, involving the proposed import and export of gas to and from Canada. Date of the hearings is set for February 14.

UNITED GAS PIPE LINE COMPANY has been granted approval on plans to build 63 miles of pipe line and a new 330-hp compressor station on its system in Mississippi, Alabama, and Florida.

SOUTHERN NATURAL GAS COMPANY has been given the green light on its plans to construct some 52 miles of pipe line and 4950-hp in compressor capacity on its system in Alabama, Georgia, Louisiana, and Mississippi. The new facilities will allow Southern to supply natural gas to 14 towns and gas districts for local distribution.

UNITED FUEL GAS COMPANY AND CENTRAL KENTUCKY NATURAL GAS COMPANY have been given tentative approval on the use of uniform rate schedules based on the contract demand form, rather than the limited service base rate form.

TRUNKLINE GAS COMPANY, whose rates have been under investigation by the FPC staff, has been given a clean bill of health by presiding examiner E. G. Simpson, insofar as they relate to working capital. The examiner noted that the staff had failed to discharge its burden of proof in several respects.

OPERATING REVENUES of reporting natural gas pipe line companies in October, 1955, totaled $152,062,-164 and for the 12-month period then ended, $1,814,295,670, representing increases of 16.9 and 17.7 per cent over revenues of like periods a year earlier. Sales of gas to other utilities for resale was up 7.1 per cent over October, 1954. Net utility plant was up 6.9 per cent, aggregating $4,438,-442,445.

IN THE FIRST 18 MONTHS OF FPC REGULATION, independent natural gas producers made 13,531 rate filings to the commission. Of the total, 3229 were rate increases, of which 221 were suspended, and 189 are still pending. Other filings included 1978 tax increases and 1030 other type increases, all of which were allowed without suspension.

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British Columbia Readying For Natural Gas Arrival

A $9,000,000 program is underway by British Columbia Electric to bring natural gas service to the metropolitan Lower Mainland of British Columbia. This program is expected to be completed by early fall of 1956 when the natural gas becomes available in this area, and a continuing gas development program, which will exceed $15,000,000 by 1959, will then be carried out.

B. C. Electric is now certified to serve the following areas with natural gas and will be ready to do so by the time the new fuel reaches the Lower Mainland:

City of Vancouver, City of New Westminster, City and District of North Vancouver, District of Burnaby, Township of Richmond, University Endowment Lands, City of Port Moody, City of Port Coquitlam, District of Coquitlam, District of Fraser Mills, Annacis Island and D. L. 172.

The Company has also applied to the Public Utilities Commission for a certificate to serve the Fraser Valley. The hearing as to the facts and law has been concluded and if approval is given, plans to serve the Valley, will be put into action immediately. Already ordered are more than $3,750,000 worth of pipe, varying from 22-in. down to small distribution sizes. First deliveries were scheduled for early January.

Mannix, Ltd. has received contract to build a 36-mile, 18-in. pipe line, which will bring the gas from Huntingdon to the "city gate," principal receiving station for the area to be constructed in Surrey, south of the Pattullo Bridge. Mannix will also lay a large-diameter line across Pattullo Bridge and on to join the Greater Vancouver grid.

Two major crossings will be built to span the Fraser River; the first via Pattullo Bridge, the other across the North Arm via the new Oak Street Bridge to Richmond. A present crossing over the Second Narrows is adequate for the near future, but will be enlarged as the North Shore continues to grow.

Right-of-way for the 18-in. main line is now being acquired. Land for the receiving and LPG storage facilities in Surrey has already been purchased. A new gas distribution center, to be located in Burnaby near Horne-Payne Substation, will cost approximately $900,000 to complete. It will be the nerve center of the natural gas distribution operation.

Cost of converting some 100,000 customer appliances to burn natural gas, which will total around $1,000,000, will be borne by B. C. Electric. Approximately 55,000 customers are involved. To do the job, the company will retain a firm that specializes in carrying out this kind of work.

Storage for LPG to be used for emergency supplies and for peaking purposes during the winter maximum-demand periods, will be substantially expanded. Two existing carbureted water-gas plants will be converted to oil-gas operation, which produces gas of the same thermal content as natural gas.

Already in operation are LPG facilities with a total capacity of 4,500,000 cu ft per day. Security of the area's supply of natural gas will be good with gas available from two fields via separate pipe lines.

Natural gas rates will be filed later with the P.U.C. At present the company expects to be able to introduce natural gas rates which, compared to present manufactured gas rates, will be lower by the following percentages:

a. Domestic cooking, water heating and appliances — 25 per cent.

b. Domestic space-heating — 40 per cent.

c. Commercial — 30 per cent.

d. Industrial rates will be materially lower and competitively priced with other fuels.

Gas Technology Short Course Set for May at North Carolina

The 1956 summer program for short courses in gas technology at North Carolina State College has been set for June 4 through June 29, and July 9 through August 3.

Instructors for the courses will be Frank Seely, director of the short course and associate professor of chemical engineering, and C. A. Plank, instructor of chemical engineering, both faculty members of the North Carolina State College School of Engineering.

The tuition fee for the four-week course is $100. This amount includes all text and laboratory materials required for the completion of the course. Classes will be limited to 30 students.

Ohio Fuel Takes Over West Virginia Gas Company

Ohio Fuel Gas Company management has taken over the operation of National Gas Company of West Virginia. All officers of Ohio Fuel have been elected officers of Natural Gas.

Earl C. Overbeck, chairman of the board of directors of Ohio Fuel, is chairman of the board of Natural Gas; Allen W. Lundstrum, president of Ohio Fuel, is president, and a director along with Overbeck. E. D. Bivens, vice president and general manager of Ohio Fuel, was elected to that position with Natural Gas. Other members of the new board of directors include S. M. Crocker, G. S. Young, H. E. Olson and J. R. Harvin, all officers of the Columbia Gas System in New York City.

Present officers of Natural Gas resigned as of December 31 and headquarters of the firm have been transferred from 800 Union Trust Building, Pittsburgh, to 99 N. Front Street, Columbus.

This is a step in the proposed merger of Ohio Fuel with Natural Gas. Other actions are necessary, however, before the merger can be made effective.

An application is pending now before the Ohio Public Utilities Commission seeking approval of merger plans. Approvals must also be obtained from the Federal Power Commission and Securities and Exchange Commission in Washington.

The proposed merger of the two Columbia Gas System subsidiaries is part of a plan to simplify the corporate structure of the system.

Lundstrum will replace J. C. Peterson as president of Natural Gas Company of West Virginia, and Bivens will replace Fred W. Batten. Peterson will continue as president and Batten as vice president of The Manufacturers Light and Heat Company, and other companies in Columbia's Pittsburgh Group.

Natural Gas serves about 34,000 customers in Alliance, Salem, Cadiz, Columbiana, Canfield, Sebring, Carrollton, Leetonia and other towns in nine eastern Ohio counties.

Cascade Gas Franchise Renewal Approved

Renewal of Cascade Natural Gas Corporation's franchise to distribute gas in 25 Pacific Northwest cities has been approved.

Transcontinental Gas Splits Common Stock Two for One

Stockholders of Transcontinental Gas Pipe Line Corporation at a special meeting approved a 2-for-1 split of the company's 3,530,000 outstanding shares of common stock. To provide sufficient stock to effect the split, the stockholders also approved an increase in the authorized common stock from 5,000,000 to 10,000,000 shares. Each holder of common stock will receive a new certificate equal to the number of shares held of record on January 20, 1956. Directors of the company declared an initial quarterly dividend of 22½ cents a share applicable to the split stock, payable February 1 to holders of record January 20. Holders of over 3,000,000 shares, or 86 per cent of the outstanding shares of the company's common stock, were represented at the special stockholders meeting. In addition to the stock split, the shareholders approved a stock option plan designed to enable the company to retain and attract key personnel. The stock which may be issued under this plan is limited to 200,000 shares.

Brooklyn Borough Employees Rewarded for Safety

Continuing its safety campaign, with its year-round slogan, "MAKE EVERY DAY SAFETY DAY", Brooklyn Borough Gas Company at Coney Island will reward all employees, excepting staff members and officers, with an extra day off with pay in 1956, for reducing to a total of six the number of lost-time industrial accidents in 1955.

The Company's automobile drivers improved their previous record by reducing to a total of three the number of preventable automobile accidents in 1955. In recognition of this accomplishment, each of the 84 drivers of Brooklyn Borough Gas Company cars, will receive a $25 United States Government Savings Bond.

The Company kept the matter of safety constantly before the employees. Credit is given the company's executive committee of the safety council for its analysis of safety procedures and excellent work in planning the company's efforts to provide safe service for its customers and safe working conditions for its employees. Philip B. Baas, the company's secretary, is the chairman of the Safety Council Executive Committee that establishes the company's safety program and directs the activities of the safety council. The committee is composed of all the company supervisors and operates under the direction of a chairman who serves for a period of six months.

AGA Appoints Committee Chairmen for 1956

Dean H. Mitchell, president, American Gas Association, has announced the appointment of chairmen of various committees of the AGA Board of Directors. Among the new charimen named for the 1956 association year are: **R. A. Malony,** president, The Bridgeport (Connecticut) Gas Company, chairman of the AGA General Convention Committee; **R. R. Blackburn,** vice president, Southern California Gas Company, Los Angeles, chairman of the Executive Committee on Excess Liability Insurance; **Frank C. Smith,** president, Houston (Texas) Natural Gas Corporation, chairman, Executive Conference Committee, with **W. E. Mueller,** president, Colorado Interstate Gas Company, Colorado Interstate Gas Company, Colorado Springs, Colorado, as vice-chairman of that committee.

Mitchell will serve as chairman of the Executive Committee of the Board. **James F. Oates, Jr.,** chairman of the board, The Peoples Gas Light and Coke Company, Chicago, will be chairman of the Special Committee of Executives on Public Affairs, while **Ernest R. Acker,** president, Central Hudson Gas and Electric Corporation, Poughkeepsie, New York, will head the AGA Finance Committee. **G. H. Sandusky,** superintendent, consumer services, Southern California Gas, is chairman of the Committee on Gas Appliances, and **J. H. Dennis,** utilization superintendent, Long Island Lighting Company, Mineola, New York, will be vice chairman of that committee.

N. B. Bertolette, president, The Hartford (Connecticut) Gas Company, will serve as chairman of the Laboratories Committee, and **William G. Rogers,** president, The East Ohio Gas Company, will be vice chairman of that committee. **N. C. McGowen,** president, United Gas Corporation, Shreveport, again will serve as chairman of the Committee on Natural Gas Reserves. **W. L. Shomaker,** vice president, Northern Natural Gas Company, Omaha, Nebraska, was appointed chairman of the General Nominating Committee.

H. R. Derrick, president, Alabama Gas Corporation, Birmingham, Alabama, will be chairman of the PAR Committee. Serving with him as vice chairmen will be **John E. Heyke, Jr.,** president, The Brooklyn (New York) Union Gas Company, **Henry A. Eddins,** executive vice president, Oklahoma Natural Gas Company, Tulsa, and **Edward G. Twohey,** president, gas division, New England Electric System, Malden, Massachusetts.

Other committee chairmen in 1956 will be: **A. W. Conover,** president, Equitable Gas Company, Pittsburgh, chairman of the Executive Safety Committee; **Charles H. Mann,** treasurer, Columbia Gas System Service Corporation, New York, chairman, Committee of Executives on Taxation; and **F. D. Campbell,** president, New England Gas and Electric Association, Cambridge, again will serve as 1956 chairman of the AGA Committee on Atomic Energy.

Robert M. Drevs, secretary, The Peoples Gas Light and Coke Company, Chicago, has been appointed chairman of the AGA Corporate Securities Committee for the 1956 association year. **Robert T. Sprague,** manager, Insurance Department, Cities Service Petroleum, Inc., New York, will serve as chairman of the Insurance Committee.

Mildred R. Clark, home service supervisor, Oklahoma Natural Gas Company, Tulsa, has been appointed chairman of the AGA New Freedom Gas Kitchen and Laundry Committee. **Remick McDowell,** vice president, finance and public relations, The Peoples Gas Light and Coke Company, Chicago, has been appointed chairman of the General Public Inforation Planning Committee. **James F. Purcell,** manager of public relations, Northern Indiana Public Service Company, Hammond, Indiana, has been appointed chairman of the Public Information Projects Committee.

F. W. Kraemer, Jr., supervisor of stores, general office, New Orleans Public Service, Inc., New Orleans, has been appointed 1956 chairman of the AGA Purchasing and Stores Committee.

American Welding Society Show Set for May in Buffalo

The fourth Welding Show, sponsored by the American Welding Society, will be staged in the Memorial Auditorium, Buffalo, New York, May 9 to 11.

Twenty-one technical sessions, with approximately 50 speakers are planned. An innovation this year will be a discussion of safety, health, and fire prevention by the society's technical activities committee. Other features planned include a Welding Conference, which will consider practical aspects of welding for industrial executives and live demonstrations of welding processes and equipment.

Men At Work IN THE GAS INDUSTRY

● **Howard R. Meeker** has been appointed a member of Citizens Gas and Coke Utility board of directors. He will replace **I. E. Woodard,** resigned.

● **Jesse Bitler,** Columbus District meter repairman, the Ohio Fuel Gas Company, has retired. He has been with Ohio Fuel 27 years.

R. C. Hayes

● **Robert C. Hayes,** former field director of the Association of Washington Industries, has been named vice president and executive director of the newly formed Association of Washington Gas Utilities.

● **Ed Parkes,** director and vice president and general manager of United Gas Corporation, Shreveport, Louisiana, has been appointed a director of the American Gas Association for a two year term ending in October, 1957. He succeeds the late **M. A. Abernathy.**

● **Joseph Bowes** has been elected chairman of the board of Oklahoma Natural Gas Company. **H. A. Eddins** was named president. Bowes had been president of Oklahoma Natural since 1936 and will continue as principal executive officer. Eddins had been executive vice president of the company since 1954.

A. E. Brawshaw, who was chairman of the board since 1933, remains as a director and a member of the executive committee. All other officers were re-elected, including **Fred W. Peters,** vice president, secretary and treasurer, and **George Frederickson, C. C. Ingram, H. Vinton Potter** and **P. K. Wallace,** vice presidents.

● **Anthony B. Young** has been appointed assistant advertising manager of The Peoples Gas Light and Coke Company, Chicago. He has been with the company 15 years.

● **R. Dean Grimm** of Bartlesville, Oklahoma, has been appointed to the newly created position of manager of gas reserves and availability in Northern Natural Gas Company's Supply Department. He has been assistant manager of the Gas Reservoir Department of Phillips Petroleum Company.

● **Roger F. Strauss,** engineer-lawyer of the Ohio Fuel Gas Company rate department, has been promoted to attorney in the legal department. He has been associated with Ohio Fuel since 1928, and previously served as manager of company offices in Medina and Berea.

● **G. Arnold Johnson** has been named an executive assistant to Dr. H. L. Purdy, executive vice president of British Columbia Electric. His chief duty will be concerned with the conversion of the company's present manufactured gas system into natural gas. Johnson has been with the company since 1945.

● **Wesley F. Wright,** pioneer developer of the natural gas industry in Dallas and the Southwest, retired December 1 after 44 years of continuous service. Wright, Lone Star Vice President, began his gas industry career a year after natural gas was brought to Dallas and Fort Worth in 1910. **L. A. Bickel** has been elected vice president to succeed Wright. Bickel will be in charge of operations in the Company's Dallas division of distribution.

Also announced is the election of **F. A. Garrett** as assistant general manager of the Dallas division to succeed Bickel. Garrett had been division purchasing agent and building manager for 14 years.

● **Joseph F. Weiler** has been appointed attorney in charge of the legal department of Texas Eastern Transmission Corporation. Prior to employment with Texas Eastern, he was an attorney for Transcontinental Gas Pipe Line Corporation.

● **Charles G. Simpson,** director of finance and accounts, Philadelphia Gas Works Division, The United Gas Improvement Company, Philadelphia, and **E. Gordon Black,** vice president and treasurer, Milwaukee Gas Light Company, Milwaukee, have been elected to membership in the Controllers Institute of America.

● **J. E. Bixby** has been appointed assistant treasurer of Texas Eastern Transmission Corporation. Prior to joining Texas Eastern, he was comptroller, assistant secretary and assistant treasurer of W. S. Bellows Construction Corporation of Houston.

● Officers of the New Washington Natural Gas Company recently formed by the merger of Washington Gas and Electric Company and the Seattle Gas Company are: **Walter S. Byrne,** president; **Charles M. Sturkey,** executive vice president and general manager; **Norbert O. Fratt,** vice president in charge of sales; **B. T. Poor,** vice president and southern division manager; **Almon Ray Smith,** secretary; **Richard D. Smith,** treasurer; **Leland E. Jones,** northern division manager and assistant treasurer; **Howard Kroehl,** assistant secretary and comptroller.

General offices of the Washington Natural Gas Company are in Seattle, Washington. Southern division office is in Tacoma, Washington.

● **George F. Knight,** assistant general manager of The Consumers' Gas Company since 1952, has resigned. He had been associated with Consumers' Gas 13 years and was responsible for all the company's outside operations, including the transmission of natural gas from the Niagara Frontier, expansion of facilities and other planning and of Toronto distribution and service. He was on the Board of Directors from 1951 until 1954.

A. B. Young | R. D. Grimm | R. F. Strauss | G. A. Arnold | W. F. Wright | L. A. Bickel | G. F. Knight